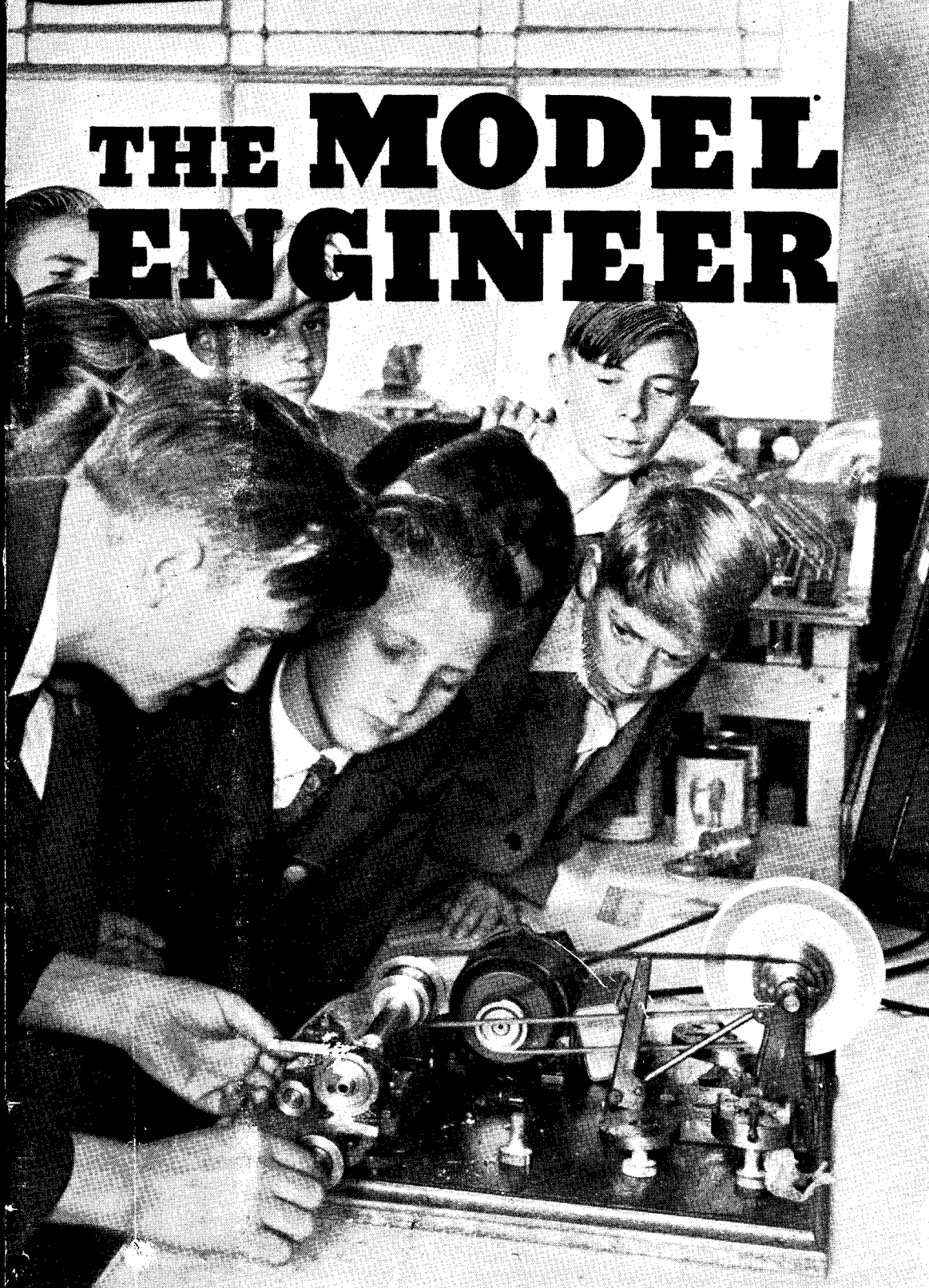
THE MODEL ENGINEER



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The MODEL ENGINEER

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10TH NOVEMBER 1949 VOL. 101 NO. 2529

SMOKE RINGS

Our Cover Picture

● THE PROBLEM of interesting and attracting the rising generation is one that is being seriously tackled by many model engineering societies, who recognise in the juvenile of today the potential model engineer of tomorrow. It is not, however, so easy to capture the lasting interest of the youth, as those who think that all model engineering is child's play would have us believe. The modern youth is certainly mechanically-minded and full of enthusiasm; but he is generally much less interested in the process than the product, and liable to prefer a pursuit which yields quick results to one which calls for patience to acquire skill and proficiency. There are, however, encouraging signs that the trouble taken to demonstrate and explain model engineering to juveniles is not entirely wasted; a significant pointer is the steady improvement in the quality of work entered in the junior section of model exhibitions, some really fine examples of which have been observed of late. Our photograph shows a group of boys watching a demonstration of lathe work by Mr. H. Collier, hon. secretary of the Coventry S.M.E., and to judge by the intense concentration depicted on the faces, there is more than one potential model engineer among them. Demonstrations of "how it is done—and why" should always form a feature of club activities whenever possible, as there are many potential recruits, both young and old, who are ready to try their hands at model construction if once they are shown the way.

The Second "Northern Models Exhibition"

● THE NORTHERN Association of Model Engineers announces that the second "Northern Models Exhibition" will take place at the Corn and Produce Exchange, Hanging Ditch, Manchester, from March 24th to 26th, 1950.

The show will be arranged in five sections, viz: "A," Locomotives and Railways; "B," Marine Models; "C," General Models; "D," Juniors, and "E," Model Aircraft. All these classes will cover models entered for competition, subject to the following conditions: Each entry must be the work of the exhibitor; a separate form must be used for each entry; a fee of 2s. 6d. per model will be payable by senior exhibitors, but juniors, who must be under 17 years of age on March 23rd, 1950, will pay no entry fee; models which have won a first award in either a national or N.A.M.E. exhibition will not be eligible as competition entries, but will be welcomed for the Loan Models section, for which no fee will be charged. Other incidental but important information is available on the official entry-forms, which can be obtained from Mr. A. F. Stevenson, 2, Newlands Drive, Prestwich, near Manchester, to whom all forms must be returned, duly filled in, not later than January 31st, 1950.

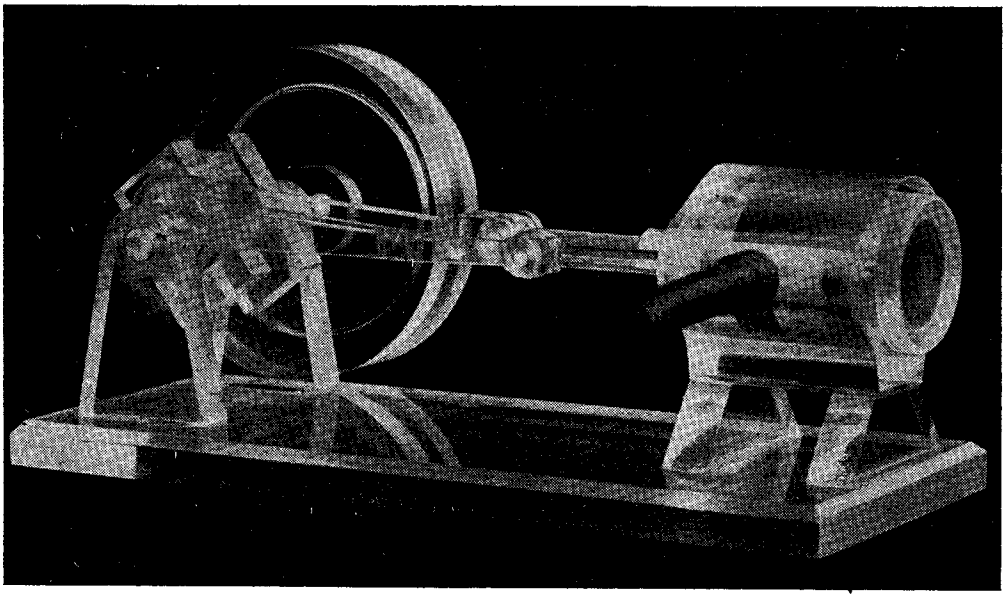
The Old Oak Locomotive Club

● WE ARE delighted to learn from Mr. V. Chellingworth that the above club has been successfully launched. It has upwards of twenty members, at the moment of writing, and they are drawn, of course, from shed staff and enginemen on the Western Region of British Railways stationed at, or within easy reach of Old Oak Common Locomotive Depot.

For some time, negotiations have been in hand with a view to arranging for a permanent meeting place, some workshop accommodation and other facilities, and we are glad to learn that the promoters of the club have won most of their requirements. A problem still to be solved is the provision of a suitable piece of ground for a locomotive running track.

Transparent Working Models

● FOR THE purposes of illustrating and demonstrating mechanical principles, there are obvious possibilities in the use of models in which the motion of all working parts can be observed. But often the complete enclosure of some of the parts is a necessary condition in the function of an engine or machine, and in such cases the only way in which they can be made visible is by making the model partly or entirely transparent. In the past, some excellent working models have been made in glass, but the difficulties of cutting and shaping this material have prevented it becoming popular among model engineers. The modern transparent plastic materials, such as Perspex and Catalin, have, however, opened up some entirely new possibilities in the construction of transparent working models, as these materials can be worked by the normal processes, including turning, filing, bending and cementing, and can be finished to produce a high polish and transparency. We illustrate here an interesting model of a double-acting slide-valve engine built by Mr. Haydn Smith, of the Orpington Model Engineering Society. It is made entirely in Perspex, even to the screws securing the cylinder cover and split big-end bearing. The piston, and the lands of the valve, are blackened so as to show up clearly when working. Paraffin is used as a lubricant, to avoid affecting the transparency of the working parts and the engine runs well on compressed air. The photograph was taken by Mr. Tryhorn, of the Orpington Photographic Society, and he is to be complimented on the successful way he has dealt with a very difficult subject.



Reorganisation at Ickenham

● WHEN SENDING us his latest club announcement, Mr. C. F. Clarabut, who is Press Relations Officer of the Ickenham Society of Model Engineers, informs us that the administration of the society has lately been reorganised and a new secretary appointed ; he is Mr. A. R. Dunn, 27, Ivyhouse Road, Ickenham, Uxbridge, Middx, who will be pleased to give any information to enquirers. " Live Steam " is strong in the ranks of the society, and there are a number of members who are interested in the smaller gauges of model railways. But there is also a developing interest in model boats, cars and other aspects of our hobby. Meetings are held every Friday, at 7.30 p.m., at the Memorial Hall, High Road, Ickenham.

Evidently, a keen and enterprising policy is being pursued by the society's executive, and we hope it will maintain progress and development for the society for many years.

Why Not a Steam Engine?

by B.C.J.

THOSE people who imagine that the initials B.C.J. at the head of an article must necessarily be followed by a homily on the hot-air engine, its faults and failings, may not always have made a correct surmise—indeed they may be woefully wrong.

A search among back numbers of THE MODEL ENGINEER will serve to prove this fact. For the rather suggest that I am about to plunge into a deep discussion on the locomotive and its valve operating mechanism. This is by no means the case. It is in fact the stationary steam engine—and indeed a particular engine—that is about to receive attention.

When I was a very young man there were *two* engines, more perhaps than any others, that

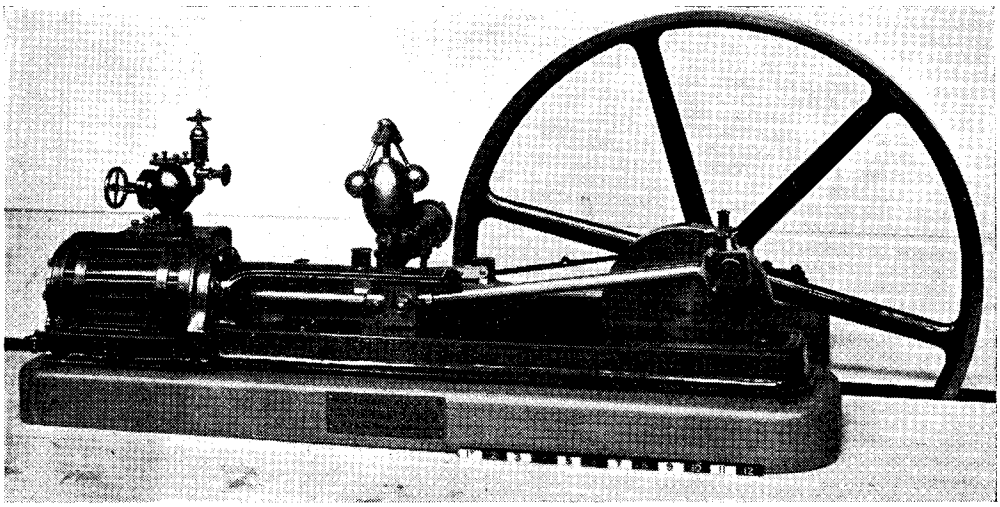


Fig. 1. A fine model of Hornsby steam engine on view at South Kensington. Note the soleplate mahogany-lagged cylinder and large flywheel

searchers will find, amongst other things—beam engines, steam engines, gas engines, hydraulic engines, and, of course, that much beloved machine, the railway engine.

The name *Joy* should be a sufficient guarantee of my interest in *that* beautiful piece of machinery, which is still—thank goodness—propelled by steam as it was at the beginning of last century. For if I may not call myself a locomotive lover, why, tell me, have I frequently in the past thought it a worth-while business to walk a distance of 2 miles merely for the sight and sound of a locomotive, and why, once again tell me, have I frequently travelled the road a distance of 22 miles for little else than a forty-minute sojourn at a railway station where the big fellows may be viewed at close quarters and in great variety. And here I recall the fact—and must set it down—that on one occasion an L.M.S.(?) locomotive pulled up right in front of me, as though for inspection, and this locomotive was fitted with an outside Stephenson link motion (without eccentrics), in my opinion the best and simplest application of the Stephenson gear that has ever been! (I believe there is no other engine similarly fitted.) The above remarks excited my interest and they were both horizontal engines. The first was a fine horizontal compound condensing engine installed at the Crystal Palace. I wonder if there is any recognisable part of the engine in existence now? The second, a beautiful model of a Hornsby horizontal engine at the Science Museum at South Kensington—I have little doubt that this engine is still at Kensington and is still attractive to the would-be engineer. I cannot indeed imagine a more beautiful model to have in one's possession, and one that would more completely satisfy one's desire for contemplating moving parts. Fig. 1 is from a photograph of the engine.

As for the Palace engine, well, I can say without hesitation, that I have never since had the good fortune to stand close to and watch so fine a piece of machinery in motion. I must not forget however, the beautiful diagonal paddle engines of the old Newhaven & Dieppe steamers, the *Rouen* and the *Paris*.

In the Palace engine there were to be seen and otherwise sensed, mahogany lagged cylinders, a Porter governor with its slotted link and die, polished connecting-rods and eccentric-rods, well oiled slide-bars and piston-rods, oil boxes

and oil cups, a slight sizzle of steam from a stuffing-box, an odour of hot oil, a regular—*Thump*, thump-*Thump*, thump-*Thump*, thump of some moving part, and to finish the picture a large broad-rimmed flywheel which must, I think, have run to a diameter of sixteen feet or more. Thus and thus I grew to love the stationary steam engine.

A Second-hand Engine—and a Boiler

For some years I have been accustomed to keep a diary and a special section is reserved for workshop suggestions. Now for several years has appeared the following: "Purchase sizeable steam engine and boiler." And in the autumn of '48 when the leaves were fast falling, I decided to make this remark effective. I was desirous not to incur too much expense at the outset and I therefore decided to purchase a second-hand engine—probably through the advertising columns of THE MODEL ENGINEER—and to put together some kind of steam-generator by making use of material lying dormant in my workshop. But the boiler outlook did not appear very promising—at first.

On the floor of my workshop, however, plumb in the centre, black and unobtrusive, was a device known as a space heater—I think the correct name is "Florence" heater; any other feminine name would have suited it equally well. This heater consisted of a square box-like device, 14 in. × 14 in. × 25 in. in height. At a low level inside the box there was an efficient paraffin burner, providing a very hot blue flame. (Used as a space heater, the temperature of my workshop, which is a large one, was raised 8 deg. in 30 min.—not bad going.) But my intention was to convert this heater into a boiler—or part of one. There was plenty of clear space inside, if I could only find the right kind of receptacle or container to occupy it And I did find one.

In a corner on the floor of my workshop, there had been for some years a welded drum 6 in. diameter × 10 in. long which had originally been used as a vacuum vessel, though indeed it had been tested to 100 p.s.i. If this vessel were to be fixed in some manner immediately over the hot flame, where no draught could come near it, I should have a fairly effective boiler—though indeed it would be no more than a "pot" boiler such as was associated with one's very early steam engine experiences. Now it seems well to leave the boiler—though it will be dealt with fully later—and describe the engine and its accessories.

The Engine Described in Detail

In the autumn, therefore, I set to work with a will. Not only did I have an advertisement inserted in this journal, but I studied the advertisement columns as well and it was not long before a suitable kind of engine appeared on the horizon. I proceeded to purchase it for the sum specified. When stripped of its packing case and laid bare on the floor of my workshop, the engine was not quite what I had pictured it—nothing ever is. It also had blemishes, which, at the time, appeared incurable; it had a dog's hind-leg eccentric-rod for the pump, with two flats and a misdrilled hole at the pump end, a badly rusted and attenuated connecting-rod, no means of valve adjustment, no lagging on the cylinder, no cylinder drain cocks, very unsightly lugs on the eccentric straps, rust on the crankshaft and flywheel rim, some very misshapen nuts undecided whether to pose as hexagonal or pentagonal, and a rough and ready crosshead, the whole mounted upon a piece of roughly enamelled wood about ½ in. thick! This did

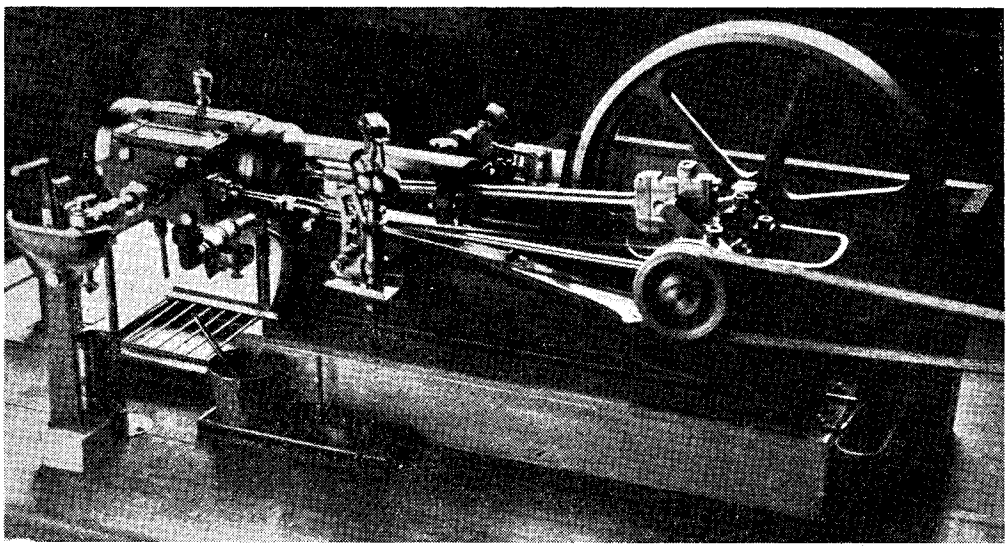


Fig. 2. Close-up view of engine, showing design of soleplate, overhung lagged cylinder, 10-in. flywheel and guard, driving pulley, belt, governor and link, drip tray, etc.

not appear to be very good value for the amount paid.

But it has been a labour of love to correct all these blemishes and also to add many little accessories and additions such as to apply finish where there was none, and to put a little enamel here and there, so that I really must claim that the engine, in all its smartness, now looks distinguished enough to occupy a high place amongst the fine specimens at South Kensington ! And I say this in all sincerity.

I am, therefore, in no way displeased with my purchase of a second-hand engine which is likely to have been resting and rusting in some out-of-the-way corner, where there is much dust and dirt ! How, under such circumstances, can one expect any contrivance to *look* as good as new ?

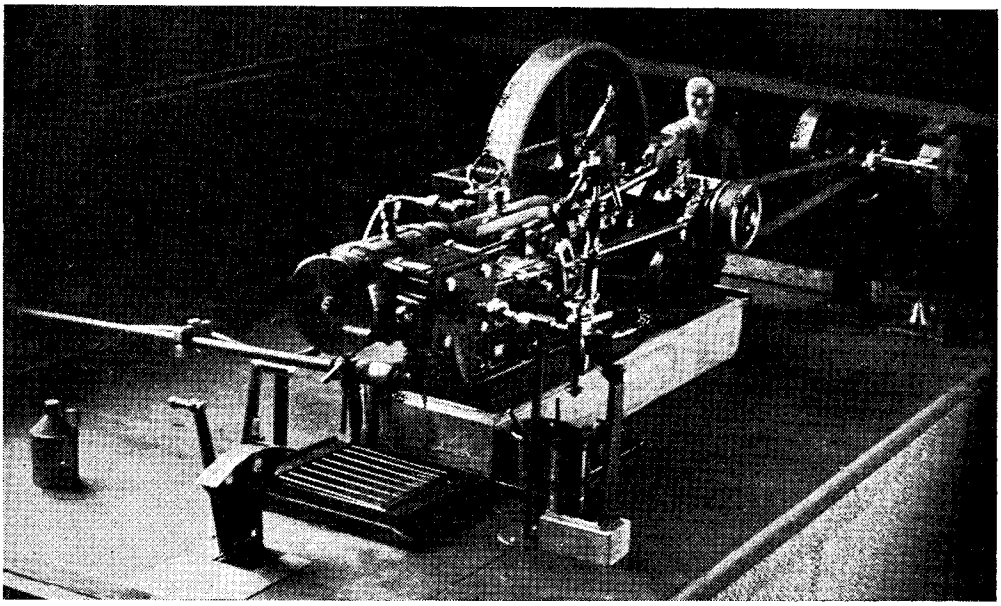


Fig. 3. General view of " engine room," showing walls on two sides, steam lever and quadrant, grinding machine, exhaust pipe, steam pipe through floor, and dummy figure

The Photographs

Figs. 2 and 3 represent two slightly different points of view of the engine which, it will be observed, is mounted permanently on a good solid table—which in my opinion is the proper manner of dealing with any respectable engine. It will be seen that there is a background to isolate the engine from its surroundings so that one gets a much better suggestion of reality than would otherwise be the case.

As for the engine itself, the soleplate is a substantial satisfying piece of construction, an iron casting and a good piece of design on the whole, but somewhat thin-waisted. I am unable to decide whether this casting is a near copy of some well-known engine type—possibly Tangye—or, whether it is an amateur product. It is a good casting anyway, and provides an engine of much better appearance than that type of old-fashioned machine in which the cylinder, bearings, etc. were mounted on a piece of plate, and the plate was supported on stilts—I cannot think of a better term. The bored guide and the crosshead are quite satisfactory. The connecting-rod is a long one, the between-centres length being no less than 9 in., which is considerable when the throw of the crank is no more than 1½ in.(thus length of connecting-rod equals 6 crank throws). The big-end is unusual, studs replacing the usual bolts, and there is a neat oil-box on one of the brasses (my own contribution).

The cylinder, and part of the steamchest, are mahogany lagged, a difficult piece of work, but satisfying to the eye with its polished brass bands. The cylinder cover has a polished steel protecting cover to guard against condensation hereabouts. Among other things, which add something to the engine's interest and appearance, are a dummy governor with adjacent slotted link and die, a dummy rev. counter, a flywheel guard, a crank guard, a displacement lubricator—and goodness knows what beside.

Getting Rid of Condensate

In handling small steam engines in the past, it has been my invariable experience that any part that can by any possibility, leak and drip drops of water, does leak and drip drops of water, so that in a short time there is a pool round the base of the engine—which has to be mopped up. The old " Ajax " locomotive was a grave offender in this direction and there was a lot of mopping up to be done after a run.

Now I was determined to have a dry engine and engine-room floor and with this in view,

various devices were brought into use, all of which operated successfully.

I was determined to make an end of the " water, water, everywhere, nor any drop to drink " business. The first step was to locate a shallow tray about ½ in. deep, immediately below the engine cylinder (this tray can be observed in both the photos) (Figs. 2 and 3). Now the

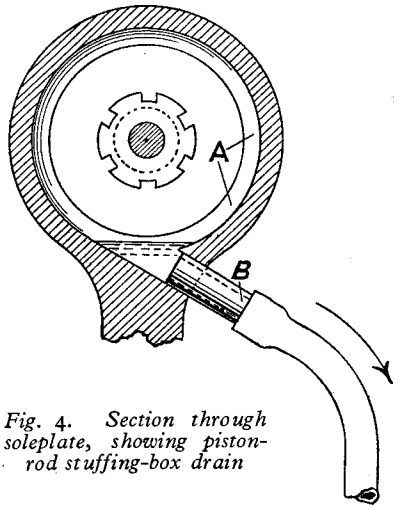


Fig. 4. Section through soleplate, showing piston-rod stuffing-box drain

worst drip-spot, as was to be expected, was the piston-rod stuffing-box. There was, however, an annular channel formed in the soleplate hereabouts (see *A* in Fig. 4). Whilst this channel received the condensate from the stuffing-box in a satisfactory manner, it did not dispose of it, for this water overflowed on to the lower part of the bored guide, and was washed and swashed about by the crosshead in small waves reminiscent of the seashore in summer-time. The thing was to drain this channel, and a hole was drilled at a suitable angle and—partly by good luck and partly by good management—this hole met the recess just at the right place. A short length of copper pipe and a little rubber tubing connected the recess with the above mentioned tray. And that was that !

Now the valve spindle stuffing-box contributed its little share of the drip-drop business. But in this case a small cup was suspended from the gland by a hooked wire, which permitted the cup to be tilted over, and the water to be discharged into the tray. This little device is well illustrated by the line drawing (Fig. 5).

The cylinder drain-cocks discharge condensate into the tray when the engine is in the process of warming-up, and any slight leakage from the exhaust fittings also finds its way there, so filling the tray. This never overflows however, as the engine is furnished with an excellent little eccentric-driven boiler feed pump. The pump however, is not required for boiler feeding, as will be explained later, but is more usefully employed, for it draws up every drop of water in the tray and discharges it into a conservatory just outside my workshop, where on occasions it sprinkles certain large rats, who shake themselves, but seem to care very little (I have seen this happen).

Flywheel Suggestions

The flywheel of the engine now in my possession, and which I am describing in detail, is of goodly proportions—and it ought to be—it has a diameter of 10 in. and a rim width of 1⅛ in. It may perhaps weigh as much as 5 lb., though I haven't weighed it. The spokes (*F*) were originally too clumsy for my liking, but they have been subjected to a good deal of filing—rough and smooth, so that they are now quite shapely. The rim (*G*) of the wheel has undergone a good deal of treatment. Very few spoked wheels, that I have been acquainted with, measure the same thickness of rim at every point in the plane of revolution, and these divergencies give a decidedly wobbly appearance to the wheel when revolving. Correction of this fault is by no means difficult, it is only necessary to take a good half-round file and remove all the portions represented by the black surfaces (*H* in Fig. 6), so that measurements, with a pair of calipers or gauge, are all equal, as suggested by the dimension lines in Fig. 6. I have treated two or more flywheels in this manner and found it well worth while.

Fig. 7 is a section of a flywheel rim, indicating by heavy lines where machining is desirable. Fig. 8 shows a section of a flywheel rim such as is seldom met with in model engineering, but is the usual kind of wheel to be found on traction engines, horizontal steam engines and the old portable. (Note the light section of the rim and the oval section spoke.) Those good people who indulge in model traction engine construction usually fail to produce a really nice-looking flywheel. Why ?

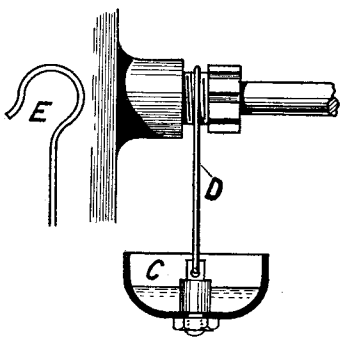


Fig. 5. Drip-cup for valve-spindle stuffing-box

Other Engine Details

There are a few minor details which perhaps I may be permitted to mention. There being no means of valve adjustment on the engine as received, something had to be provided and this something took the form of a knuckle member sliding on the eccentric-rod and secured by a saw-cut and bolt device, such as is well known to engineers.

The engine is mounted on a good solid wood plinth, which lifts the flywheel from the engine-

room floor; it is painted white and suggests a concrete block. It adds much to the dignity of the engine in just such a manner as the statue of some important personage is improved by being uplifted on a substantial plinth. (I dislike an engine laid flat upon a table, I must have a plinth.)

On the "floor" close to the back end of the cylinder, it will be observed that there are two small levers working in a quadrant. One of these is a dummy (at present) and the other operates the steam-valve on the boiler and regulates the steam admission to the valve chest very well. Thus, the revolutions of the engine can be varied from a very low speed of 35 r.p.m. to perhaps 300 r.p.m., or more. (One engine enthusiast has told me that he has never before seen a model steam engine work at so low a speed; I wonder what "M.E." readers will have to say about this.)

There is a flanged pulley mounted on the engine crankshaft and this, by means of a ½-in. belt, drives a small grinding machine. But in truth the pulley centres are too close together to provide a satisfactory belt drive and the speed of the grinding wheel is much less than it should be. Nevertheless the machine adds something to the model as a whole, and I shall retain it until I can use it better elsewhere.

The iron parts of the engine, i.e., the soleplate, and a few other details are enamelled a very attractive apple green, a colour which contrasts exceedingly well with bright steel and gunmetal, and with mahogany lagging. The flywheel is black and in this connection I cannot resist repeating the well-known story of F. W. Webb, of London and North Western fame. Consulted as to the colour he preferred for his beautiful

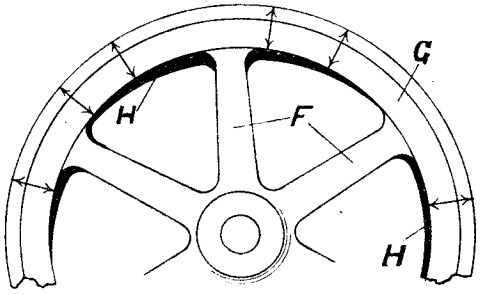


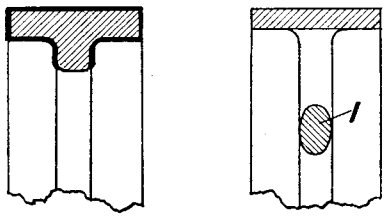
Fig. 6. Part view of flywheel, showing suggested correction

engines, he replied that "he did not mind what colour it was, so long as it was *black*." And I feel of the same opinion about flywheels.

People who have visited my workshop to have a look at my engines—there are *four* of them—have been known to make nice remarks about the surface of the enamelled parts. Well! after a coat of paint, a rub down with sandpaper, a couple of coats of enamel and a couple of days to dry, I then proceed to gently massage the surface with a finger and a little oil. It is rather a long process but quite an agreeable one, and certainly produces results.

Dummy Figures

It is quite usual when modelling villages, e.g. Bekonscot, streets and buildings, etc., to introduce dummy human figures—correct to scale. Such figures certainly add to the realism of models—such as mentioned. Now in the case of a model steam engine and its immediate surroundings, it seems that some method of suggesting *scale* as well as adding realism—if that may be—is a thing



Figs. 7 and 8. Sections of flywheel rims

to be encouraged. With this end in view, some time ago I carved at a piece of wood with chisel and knife, rasped and sandpapered it, stuck pieces of fabric on and painted it, and doctored it in various ways in an attempt to get something to look like a human figure. I was *not* very successful: indeed, some people have made very scathing remarks about the dummy—so much so that it is usually kept well out of sight. However, the dummy figure has stuck himself in a prominent place in one of the photographs—which is not at all an unusual habit of *life size* humanity!

The Boiler

In an earlier paragraph of this article I made reference to the boiler and hinted that it was a somewhat makeshift contrivance—as indeed it is.

Fig. 9 is an explanatory diagram and the letters refer to the following parts. *K* is a galvanised steel drum, which is really no more than a "pot" boiler pure and simple. *J* is the casing. The heater, fed on the chicken-feed principle from a tank behind the boiler, is represented by the letter *L*. Fuel is admitted to the heater by a turn of the valve *M*. The letter *N* is a steam-fountain or turret which carries the steam gauge *P* (20 lb. only), the safety valve *O* and a steam cock. *R* is the main steam pipe which not only conveys steam to the fountain, but supports the whole weight of the boiler from the casing top cover. Now in this connection one of the peculiarities of this steam generator must be referred to. In order to apply a light to the asbestos wick at the foot of the heater, it is necessary to lift the heater a few inches, and to do this the entire boiler, lock, stock and barrel, has to be drawn upwards and temporarily supported (I think this is unnecessary in the case of the average Lancashire boiler — indeed, I am sure it is). The steam pipe to the engine and the operating rod must be disconnected (this is a nuisance). There is a water gauge on the drum, but since this is very much in the dark and is generally pretty much furred up, I prefer, before lighting up, to dip a glass tube down the filler plug

opening. I can thus estimate a water level sufficient for a run of 1¼ hours or thereabouts and this is my normal running time.

In the absence of water tubes the boiler steams fairly well. Its working pressure is not usually more than 15 lb. and, not being a speed merchant, I get all the steam I require for my 1½-in. × 3-in. engine.

Etceteras

The casing referred to completely surrounds the boiler, and it is in this direction rather better off than the average Lancashire or Cornish boiler. Within the casing is an oven thermometer, and on the top of the casing is a small reflector to throw light on to the dial of the pressure gauge, because this important instrument, like the water gauge and the thermometer is, if not in the dark, certainly not very visible.

And lastly, partly for show, but not entirely so, there is a chimney. If there is a steam engine, there there must be a chimney somewhere! You agree?

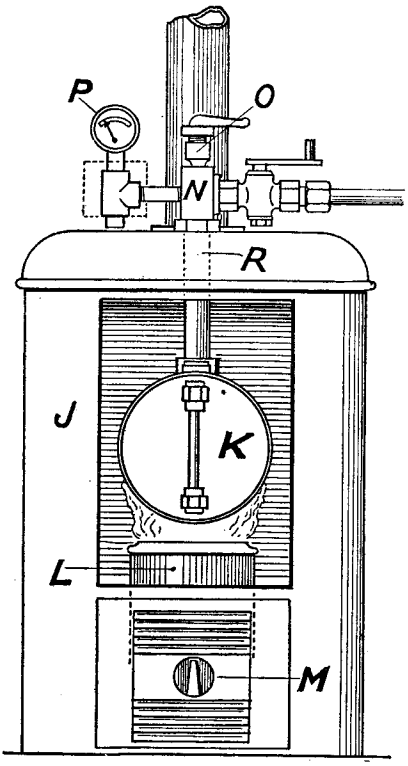


Fig. 9. View of boiler from front with door of casing open, showing heater, etc.

And To Conclude

My carefully considered opinion is that there is no class of model so satisfactorily spectacular as the steam engine, and the reasons for this are not by any means hard to find—they are indeed obvious, for in what other model will you find so many interesting moving parts, parts which are not concealed from view beneath casings and covers and crank-chambers, and whose movements are sufficiently sluggish to enable the eye to observe and study, and yes, enjoy them.

This is true of the locomotive, the traction engine, the beam engine, the undertype engine, and a host of horizontal and vertical engines in great variety. It is true also of valve-gears, connecting-rods, cranks, eccentrics, governors, slide-bars, crossheads, flywheels, and there may be other parts which have slipped my memory.

It is on account of the many fascinating and wholly visible slow-moving pieces of mechanism embodied in steam engine construction that I say to the possessor of a workshop "Why not a steam engine?"

For the Bookshelf

Ships in Bottles, by J. P. Lauder and R. H. Biggs. (London: Percival Marshall & Co. Ltd.) Price 3s. 6d.

This is a most interesting book on a very intriguing subject. Commencing with a description of the sails and rigging of the principal types of sailing ships, the book goes on to describe in great detail the technique employed at all stages in the manufacture of these fascinating models. The book is copiously illustrated with photos showing the models in various stages of completion, and line drawings of the many different fittings required. Other line drawings explain the methods employed in arranging the rigging and sails before the insertion of the ship in the bottle, and of erecting them after insertion. The only thing we do not approve of is the triatic stay leading from the jibboom over the mast-heads and down to the taffrail. When the book was being written the authors considered this necessary for the erection of the masts. Since then they have overcome this difficulty, and in their latest model—of the four-mast barque *Archibald Russell*—it is replaced by the correct royal mast stays. The book concludes with a comprehensive glossary of nautical terms and a well arranged index. The writers, one of whom is an officer in the Merchant Navy, are masters of their subject and the book should be in the hands of everyone interested in this phase of ship modelling.

An Electric Clock

with a Semi-free Balance

by Stanley J. Wise, F.B.H.I.

THE clock about to be described was designed and constructed by the writer several years ago; it is of extremely pleasing appearance, and unique in its basic operation. It was, in no small measure, due to data derived from the performance of this clock that the writer was able ultimately to design a precision balance instrument, possessing isochronous characteristics and therefore a very close time rate.

There is no doubt that a balance wheel clock (especially if the balance is of large size), is one of the most fascinating pieces of mechanism imaginable; to watch its oscillations when in action, would, I feel sure, delight the heart of any enthusiastic amateur, or indeed, a skilled mechanic, who possesses the zest and patience to construct one. Fig. 1 gives a general idea of its attractive appearance.

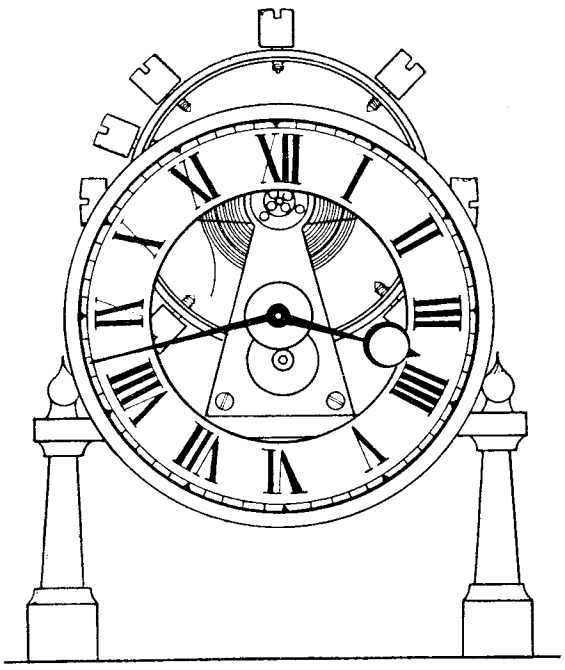


Fig. 1. General appearance of finished clock

The following instructions for making this particular model, have been drafted on the simplest possible lines, but one point must be especially stressed; namely—a good lathe is absolutely essential, and must be capable of dealing both with machining the balance, which is 3 in. diameter, and also turning fairly fine pivots, such as wheelwork arbors, contact lever staff, etc. The remaining tools necessary, are small in number; but do please use good files (of superfine quality if possible, for finishing). An assortment of *flat* buffsticks will also be needed; these should range from No. "OO", to No. 1½, carborundum or emery for medium grain, while "crocus" or "tripoli" can be used for fine finishes. All these items can be procured from a material dealer at small cost.

Although the system looks complicated, its actual construction is comparatively simple. Since the construction of the balance is the only really difficult part, it may be as well to farm this job out for brazing together the two metals forming the rim. Reasonable timekeeping can, however, be obtained by using a plain steel rim, left uncut, of course, but full instructions are included in this description, to assist the constructor in overcoming difficulties likely to be met when "tackling" the former type of balance.

It will be seen that there are two electro-magnets used in this system, one of which is carried by the balance. These are arranged to re-act with each other in such a way, as to enable equal operation on both alternating and direct current, the former being supplied by a small bell transformer, fitted within the base.

Salient points of this design are :—

(1) A balance of large diameter, practically unharnessed by any mechanical device other than lightly touching a contact member at a favourable moment, when the former is travelling at almost its highest velocity across the zero line, the period of contact being less than 1/25th sec.

(2) A contact switch, so arranged as to perform a dual purpose of (*a*) Establishing an impulsing contact to maintain balance amplitude. (*b*) To transmit electrical impulses to a simple dial mechanism at 2 sec. periods, thus leaving the balance "all but free" to perform its arc unobstructed.

(3) It is possible with this design to operate several secondary clocks by incorporating a simple relay in the balance circuit.

Balance Construction

Now the first and most difficult part for an

amateur to construct is the bimetallic rim of the balance; this necessitates brazing, or hard soldering the two metals, steel and brass, forming the rim to obtain perfect fusion at the joint. Although a skilled operator using an oxy-acetylene flame would probably think very little of accomplishing the job, an amateur might not find the problem quite so simple.

First procure a cast brass ring, or suitable

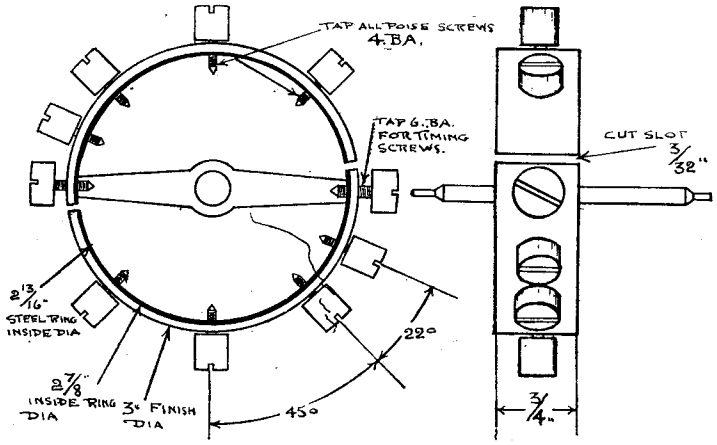


Fig. 2

length of hard brass tube; which should be of at least twice the thickness of that shown in the drawing Fig. 2, and about twice the depth, and proceed now as follows :—

(*a*) Chuck, or mount the tube on a faceplate and bore out its internal diameter to the dimensions indicated on drawings, and face up one end.

(*b*) While still in the lathe, turn three equally-spaced grooves of about $\frac{1}{8}$ in. wide within the bore, these must be of very shallow depths, about 1/64 in., and disposed as shown in Fig. 3.

(*c*) From each end of the finished width, namely $\frac{3}{4}$ in., turn two further grooves extending inwards and outwards for about $\frac{1}{4}$ in., these are to form fillets, enabling silver-solder to be "floated" in between the layers after the job is heated up.

(*d*) After removing the ring from the chuck, paint its inner surface with a liberal coating of liquid borax, or other brazing flux, working it well into all grooves.

(*e*) On a slab of firebrick, or other similar material, place the ring horizontally, and build around its outer circumference with pieces of refractory material, leaving the bore as accessible as possible.

(*f*) With a fairly intense open flame, bring the whole job up to a uniform red heat and apply the silver solder (which must be of low melting point in wire form) to each groove in quick succession, at the same time applying more flux until all grooves are completely filled. The job can now be allowed to cool.

(*g*) Rechuck in lathe and clean up the bore to exact measurements as indicated on the drawing.

(*h*) Procure a length of steel-ribbon $\frac{3}{4}$ in. × 0.025 in. (a standard gramophone spring is just right for this), and arrange matters so that when the two ends of your length are abutting, the ring thus formed can be pressed tightly into position within the bore It must fit very nicely indeed, but before finally pressing home paint both surfaces again with liquid bracing flux.

(*i*) With the job again "rigged up" on a brazing hearth, heat up as already explained in sub-para (*e*) and (*f*), floating additional flux and silver-solder into the junction, until the two metals are perfectly united; don't be afraid of piling up round the two outer fillets, ; this is as it should be! Rechuck the rim with turned face inwards, and carry out the following operations :—

(*a*) Face off the surplus brass edge sufficiently far to reach the steel liner, finishing off with a light cut across both metals with a very keen tool. The combined metals, steel and brass, should now appear as a single homogeneous surface.

(*b*) Turn outside to finished diameter, plus about 0.001 in. for finishing. Reverse the job in chuck, and face off remaining end, finishing as indicated above.

(*c*) While still in lathe, scribe a line circumferentially displaced by exactly 10 deg. from the abutment point of the steel rim, thus giving the

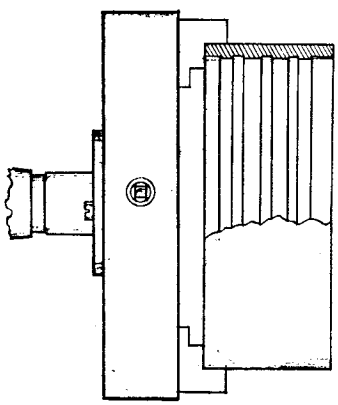


Fig. 3

correct position of one balance arm extremity in relation to the slot; the latter of which must obviously be formed at this point. Rotate the job through 180 deg., and scribe a second line, which represents the anchorage position of the remaining arm extremity.

Dead on the above scribed lines, carefully mill, or file two slots, slightly less than 5/32 in. in

width, and not quite $\frac{1}{16}$ in. deep. There should now be shaped to angular form working accurately to measurements as in Fig. 4, as applied to balance arm extremities. The ring can now be chucked from its outer face while the bore is cleaned up. No turning should here be required, the steel being " dressed " only, preferably by internal grinding, or alternatively by a medium grade emery stick held in the slide rest, until all marks are eliminated. Follow this up by a No. " O " buffstick, being careful to keep the edges of this job square and sharp.

Proceed to shape up the balance arm, working very accurately to measurements as shown in Fig. 4. Give special attention to both extremities, which must be a tight fit into their mating dove-

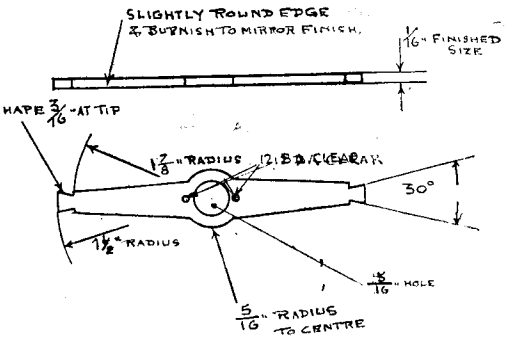


Fig. 4. Balance arm

tailed slots on balance rim. Do not drill the centre hole at this stage, since this is necessarily carried out after securing in position, when " dead " concentricity of the hole can be accomplished in the lathe.

After gently pressing the arm into position, secure the two anchorage points with silver-solder, which means again heating the job. Make quite sure that the solder has run well into both junctions, but at the same time avoid a surplus of solder piling up inside the rim, as this is difficult to remove.

The next operation consists of rechucking the job dead true by the rim, with the crossing facing outwards ; after which the following sequence is carried out :—

(i) With the job rotating in lathe, carefully turn a shallow " sink " dead true in the centre of balance arm ; follow this by a $\frac{1}{8}$-in. drill, held in tailstock, and further enlarge to $\frac{1}{4}$ in.

(ii) Bore out to final measurements as shown on drawing, using a keen internal boring tool.

(iii) Face off the crossing with keen side cutting tool, until it is reduced in thickness sufficiently to conform with face of balance.

(iv) Mark off position of timing and poise screws, drilling shallow sinks at their location points.

(v) Remove from lathe and drill the two 10-B.A. clearance holes, for attachment to staff.

The various screw holes can now be drilled and tapped—4 B.A. for poise, and 6 B.A. for timing, as shown. This job must be accurately done, since not only must their angular disposition be absolutely exact, but what is even more important, their shanks must be dead in line, i.e., disposed diametrically opposite to one another on each half-circle.

Perhaps the best way to " tackle " this is to " rig-up " the balance on the slide rest of lathe

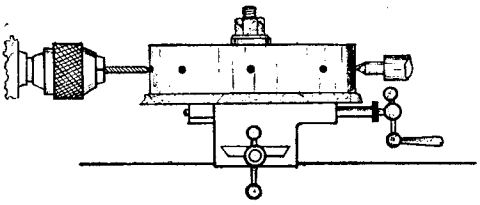


Fig. 5

as shown in Fig. 5, clamping it lightly on the toolpost bolt which then forms an axis. Interpose a disc of hard fibre or other suitable material between the rim and rest surface of sufficient thickness to bring the screw hole centres dead in line with lathe centres, use the existing or another suitable axis bolt and clamp down lightly against the " crossing " by means of a nut, collar and spring washer, thus allowing the balance to be rotated friction tight. The procedure is now as follows :—

(*a*) Line up two diametrically screw " sinks " by turning the rim and manipulating slide rest until both the back centre and drill point are in dead alignment, at which position drill one hole.

(*b*) Turn balance to position of next, or following hole, again locating with back centre and drill point and again drill, and so on.

(*c*) When all holes are drilled, follow up with 4-B.A. tap, also held in chuck, not forgetting the timing screws which are, of course, 6 B.A.

The balance can now be removed and polished

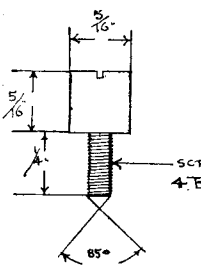


Fig. 6. Poise screws (8 off)

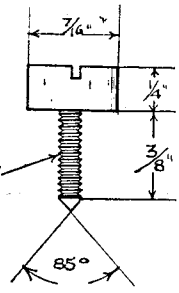


Fig. 7. Timing screws (2 off)

—medium grain for the " crossing " and internal steel rim, while " crocus " or No. " OO " emery buffsticks should be used for finishing the brass rim. Burnish the edge of " crossing " to mirror finish if desired ; this will enhance the appearance enormously. The job can now be wrapped up in tissue paper and stored until other essential parts are made.

Proceed to turn the screws from good quality gunmetal, phosphor-bronze or other "dark-brass," to measurements as shown in Figs. 6 and 7. These must also be accurately made; check all measurements by micrometer, finally polishing the heads to mirror finish with "crocus" cloth used on a buffstick.

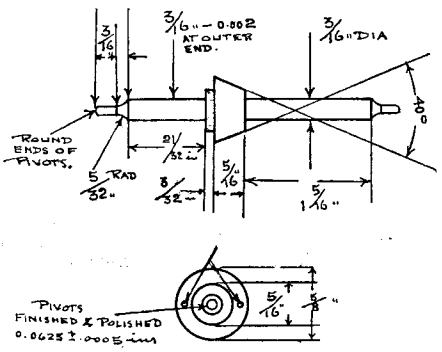


Fig. 8. Balance staff

When completely finished, check up their respective weights, which should be practically the same on all, except, of course, the timing screws. Drill also the two 12-B.A. anchorage screw holes through the arm.

Balance Staff

The construction of this important item should now be proceeded with. First procure a suitable length of $\frac{3}{16}$-in. outside diameter silver-steel, chuck dead true in lathe and "run" a slight taper over a distance of $\frac{15}{16}$ in., diminishing by about 0.002 in. at its outer end. Through a $\frac{7}{16}$ in. length of $\frac{11}{16}$ in. diameter brass rod drill a hole slightly less than $\frac{3}{16}$ in., say, 5/32 in. Ream out the hole until its entire length will just fit tightly over the reduced end of staff, the latter of which can now be pressed through until one face of brasswork is $\frac{15}{16}$ in. from the end. Rechuck in lathe and turn two cones (one on each end) dead true; these should be about 30 deg., and will be used as a basis for all centring.

The job can now be mounted between centres, and turned to measurements as shown in Fig. 8. Make sure that the spigot formed on brasswork is a fairly tight fit into the hole of balance arm. Remember that the pivots must be finally made dead to size, so leave approximately 0.0005 in. plus for finishing and polishing.

Remove the job from lathe and harden both pivots by direct "quenching" in oil, after which mount again in lathe centres and polish, first with an oilstone and finally with "crocus" and "rouge". Finish all other surfaces No. "O" buffstick until all marks, however faint, are removed, then finish with "crocus" and "rouge"; this will impart a very pleasing lustre of practically mirror brilliance. Round off both pivot ends slightly, also with an oilstone, and polish. Offer up the staff into its balance arm and mark off the two 10-B.A. screw holes, which should now be drilled and tapped. Remove every trace of burr and foreign matter from the abutting surfaces and secure with two shallow cheese-headed screws. The latter should be highly polished and blued.

Main Bearings

These are turned from a $\frac{3}{4}$-in. bar of good quality carbon steel and consist of three main parts, namely:—

(1) Housing for ball-race, forming the bearing proper.

(2) Endplate retaining cover.

(3) Glass end plates, forming both ball and pivot retainer.

First, turn the main housing to measurements given in Fig. 9, leaving the internal bore a mere fraction (say about 0.0005 in.) oversize for finishing. Keep the wall, which, of course, acts as a retaining plate, as smooth as possible; do not trouble, however, to attain a sharp corner here as a slightly rounded one will do just as well. Finish the edge of flange with No. "O" grinding slip held in the lathe. Mark out the position for three attachment screws, which should be clearance holes accommodating 12-B.A. shanks.

The job must now be hardened by direct quenching in oil, but be sure to agitate the oil while so doing. Also keep the job as flat as possible while immersing—this will avoid distortion.

It will now be necessary finally to polish the inside circumference and back face. The correct way to accomplish this is by internal grinding, but quite good results can be obtained by lightly touching the surfaces with a high grade arkansas slip (of small cross-sectional area) held in the slide rest. Mount arkansas slip in short length of copper tube (retaining it by shellac) so that only a small amount projects, followed by "crocus" and

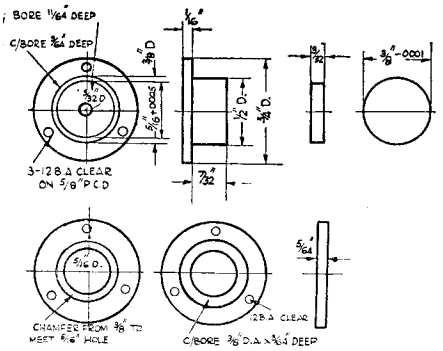


Fig. 9. Details of main bearings

"rouge", rotating the job at fairly high speed in the meantime.

Machine the endplate retaining covers from the same $\frac{3}{4}$-in. steel bar, chamfering the outer face to meet the bore as shown. Finally polish all front faces, and remove from lathe. Drill the three 12-B.A. clearance holes by marking off from those already formed in the above

(*Continued on page* 606)

Steam Cylinder Passages

A Reply to Some Criticisms

by K. N. Harris

THE article of mine on the above subject, published in the issue of June 30th came in for subsequent criticism that advanced some theories, which, to put it mildly, were unusual.

I should not normally have troubled to reply, but I have had a series of letters asking why I have not dealt with the matter; these letters came from places as far apart as Cape Town, Toronto and Otago, N.Z.

Efficient Results

I have no desire to enter into an arid controversy on the matter, for there is little to be gained by so doing. Anyone experienced in the design and construction of small steam engines which have to give efficient commerical performance, will not need convincing of the correctness of my original statements which have been known and accepted amongst steam engineers the world over for 100 years and more; others may not desire to be so convinced. It happens that in my younger days my living depended on my ability to produce designs of small steam engines which, when constructed, *would* give efficient results (still further back I was erecting and testing them), and if there is one thing which would have been more certain than another to ensure the abrupt termination of my employment, it would have been to provide those engines with steam passages of the type advocated by my critic.

With An Open Mind

For the benefit of those who have no particular knowledge of the subject, but retain an open mind, I would refer to an article by Mr. C. M. Keiller in the issue of June 15th, 1939, dealing with the performance of a small 2½-in. gauge 0-6-0 locomotive of his own design and construction having cylinders ½ in. by 1 in. embodying passages of the general proportions advocated in my article.

The facts (not theories) contained in this article should convince anybody that the principles I outlined *do* apply to small engines as well as large, even to very small engines.

Quite apart from the incidental bearing of Mr. Keiller's article on my own, it is of outstanding general interest to all model steam locomotive enthusiasts. It deals factually and most effectively, not only with the "big cylinder" theory, which is, in fact, as obsolete as the much derided "big boiler" theory, but with the use of straight slides in valve gears of the Joy type, exhaust nozzle sizes and layouts and balancing; it occupies less than three pages and it would be difficult to find in the hundred odd volumes of THE MODEL ENGINEER, three pages so closely packed with sound engineering information bearing on model steam locomotives.

"The Good Steam Passages"

For the benefit of those who have not got access to this article, I quote what is perhaps, for the purpose of this reply, the most significant paragraph in the article:

> "Although the cylinders are small (½ in. by 1 in.) the tractive effort is quite considerable, owing to the 150 lb. pressure and the 2 5/16-in. wheels, and *thanks to the good steam passages*, the small wheels do not restrict the speed at all; in fact, the observed drawbar pulls are as great at the top speed as at starting. I have obtained a pull of 7 lb. at 6½ m.p.h., about ⅛ h.p. and this with a cut-off of about 70 per cent. and 140 lb. in the steamchest. Of course, with larger cylinders the same output could have been obtained with a shorter cut-off and less pressure, but I rather wanted to see what could be got out of the despised ½-in. cylinders. I am not by any means a supporter of small cylinders, I prefer them to be of such a size that the lever can be brought well back; but if big cylinders are needed to maintain tractive effort at high speeds, then there is something wrong with the design.
>
> "I am afraid that big cylinders only too often mark losses that should be eliminated both in models and full-size engines; to say that the pistons can run away from the steam is to admit there is serious wire-drawing."

It would indeed be difficult to pack more information and fundamental common sense about model locomotive design into two hundred-odd words.

I have yet to hear of any 2½-in. gauge locomotive with a similar adhesive weight even approaching this standard of performance. The article should be reprinted in leaflet form and circulated to every model engineering society and club and every individual model engineer interested in model steam locomotives and capable of independent thinking and reasoning.

Mr. Keiller was, I believe, apprenticed at Swindon locomotive works and he has succeeded in applying the results of his early training to the production of a series of 2½-in. gauge engines which rank as some of the best-looking and most efficient model locomotives ever built in this size.

I am content to leave the matter to the judgment of qualified steam engineers and the results achieved by Mr. Keiller.

"Just a Wee Dot Like Doris"

by "L.B.S.C."

THE above paraphrase of a famous Scottish comedian's well-known song, will introduce the little sister to "Doris," the L.M.S. 3½-in. gauge class 5 engine, about which I promised, by kind permission of our friend the K.B.P. to give a few details. Having had requests from plenty of beginners and inexperienced workers who are not only sadly lacking in equipment, but also space for an outdoor line, to describe a simple type of engine which can be easily and cheaply built, and will run on an indoor line, I have tried to kill all the birds with one shot. As far as general outline goes, "Dot" is a faithful copy of her big sisters, bearing the proportions and general appearance of the L.M.S. class 5's; but her "works" are simplified absolutely to rockbottom, and to the minimum necessary for efficiency. A "baby" lathe, a few hand tools, and a one-pint blowlamp or small gas blowpipe, are all that will be needed, as long as the operator has the average amount of what is known as "common savvy." The cost of the few castings and bits of material needed, should be within the capacity of anybody's finances; and if the builder has any young hopefuls who are mechanically minded, the little engine will bring joy to their hearts, for it will not only pull about twenty coaches, but will give them a ride. That is, of course, provided that the kiddies can be persuaded to sit still on a small flat car—the hardest job of all!

Specification in Brief

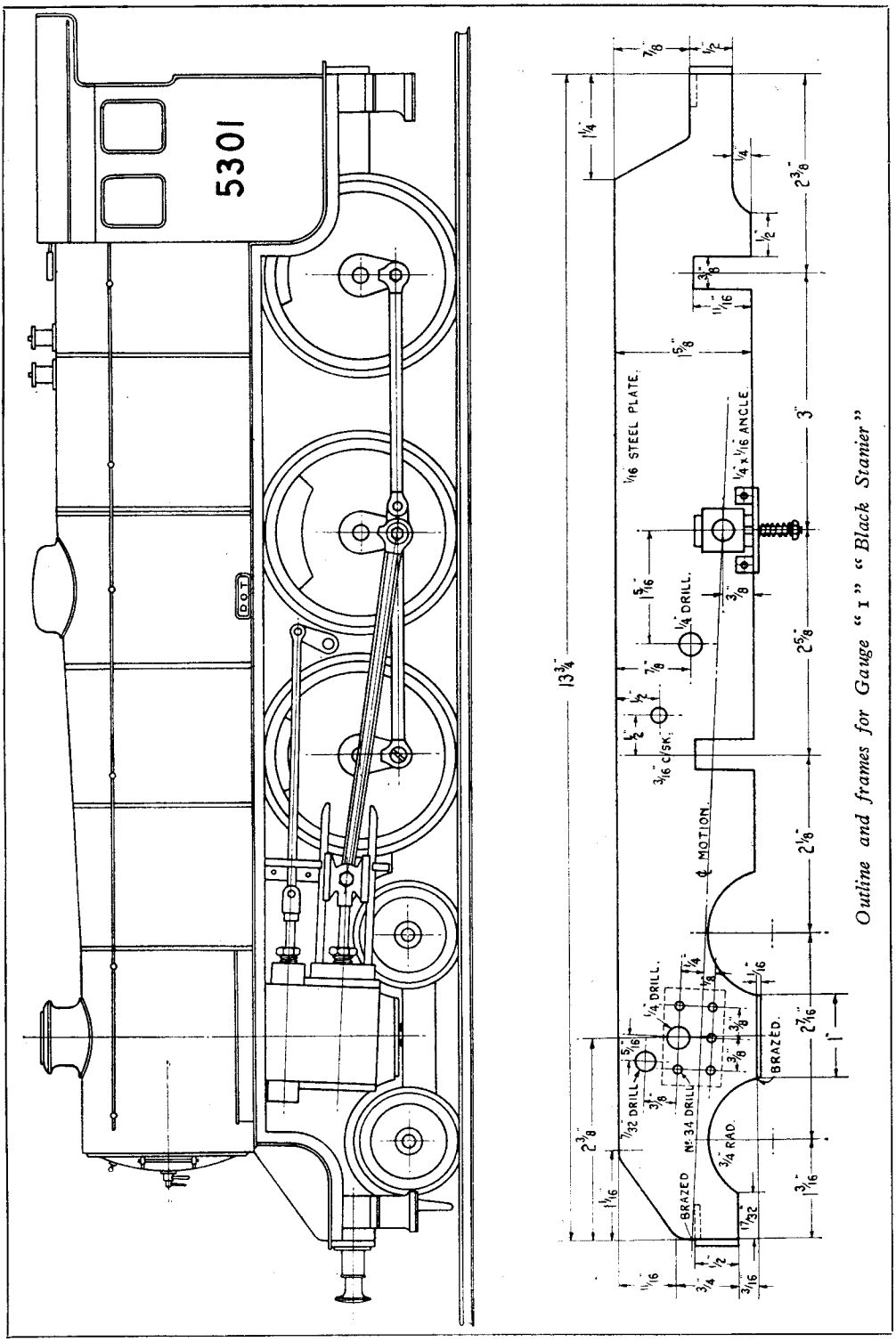
"Dot's" frames are nearly all straight lines; one evening's work, easily. No hornbacks are needed, the axleboxes working directly in the frame slots, with hornstays made from brass angle. The leading bogie is centrally-sprung, and no turning is needed for the axles. The cylinders have slide valves, which are operated by loose eccentric gear, the outside rocking lever and the long valve rod taking the place of the full Walschaerts gear; but if any reader with the necessary experience wishes to fit the full Walschaerts gear, all he has to do is to refer to the drawings of "Doris's" valve-gear (the blueprint obtainable from our offices would be of great assistance) and make the parts exactly half-size. Don't forget to reverse the connections at the top of the combination lever, also to fit the return crank to lead the main crank; otherwise the engine will back up when you put the lever in forward position. But for an indoor "scenic" railway, you can't beat the loose eccentric gear. If set to cut off at about 50 per cent., the engine will haul a long train on a mere crack of throttle, and "keep on keeping on" whilst any water is left in the boiler, and any spirit in the burners.

The boiler is of the simple water-tube type, with a copper-tube barrel and three Averill-type water tubes, inside a casing which can be made up from thin sheet steel or iron. Even tin would do; and thereby hangs a good laugh. A follower of these notes says that he has a large spam can, which once contained a goodly portion of that well-known wartime delicacy [?] and being a bit of a wag, suggests building a gauge "1" edition of the class of engine known on the Southern Region as "spam cans," utilising the metal of the actual spam can for the boiler casing; so the locomotive would be a spam can in fact as well as name!! Incidentally, joking apart, it would be a jolly good wheeze, for this reason; the boiler casing of the full-sized "spam can," reproduced on the little one, could be made to serve as the outer case of the water-tube boiler. It could be lined with asbestos millboard, to keep in the heat, and still leave plenty of room for a fair-sized inner barrel. If fitted with the same cylinders and motion that I am specifying for "Dot," the "spam-can-ette" would be a most efficient engine.

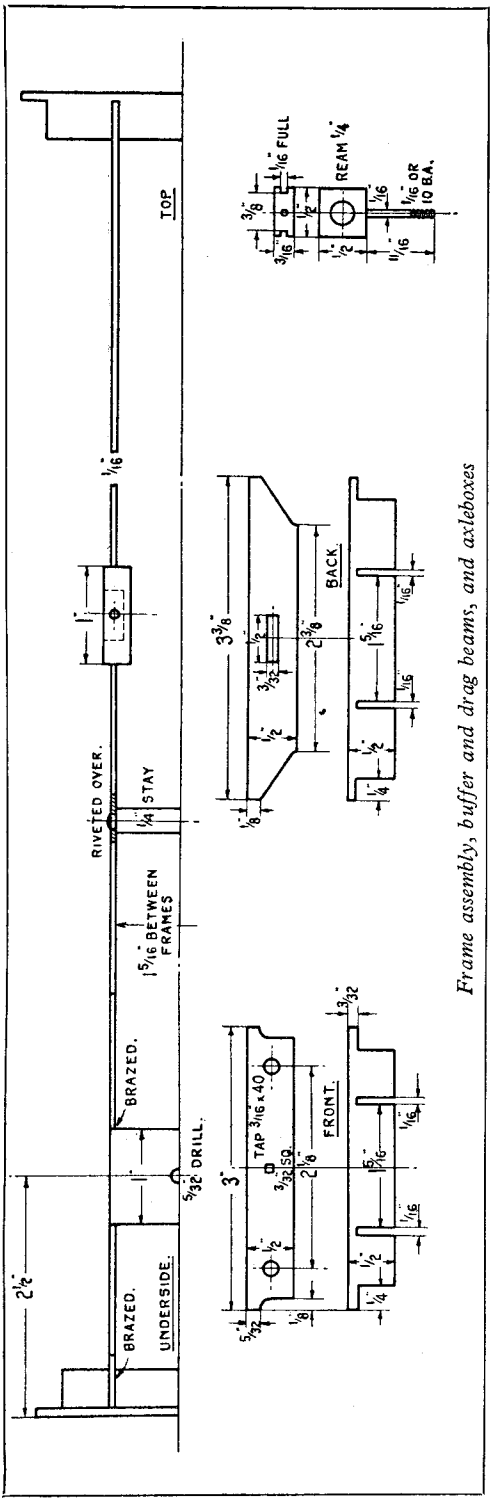
"Dot's" boiler is fired by a spirit lamp, supplied with "liquid poison-gas" from a sump, which is automatically kept filled to correct level from a tank in the tender. The fittings are cut to the bare minimum; no water-gauge is needed, as the spirit flames cannot hurt the boiler even if run dry. The boiler is fed from a hand pump in the tender, a few strokes of which every five minutes or so, are sufficient to maintain a working level. The tender itself is just a half-size copy of the 3½-in. gauge tender, but need not be sprung, and is of simpler construction. Now I'll just briefly run through the sequence of operations; there isn't any need to waste time and space going into details, because the actual machining and fitting work is similar to that being detailed for "Tich," and also for the other locomotives recently described in full, so here we go.

Frame Assembly

The main frames are cut from $\frac{1}{16}$-in. or 16-gauge blue steel or galvanised iron, all holes being drilled whilst the plates are riveted together for cutting to shape. The buffer and drag beams are made from ½-in. by 3/32-angle; brass or steel, it doesn't matter which. Note they are different lengths and shapes. The frames are stiffened up by a rod stay turned from ¼-in. round steel, 1 $\frac{5}{16}$ in. between shoulders; and if this is put in before the frames are attached to the buffer and drag beams, it will hold the lot securely whilst the frames are brazed or silver-soldered into the slots. Braze if steel beams are used; silver-solder if brass. The bogie bolster, made from 16-gauge steel, or same material as frames, is tied in position with thin iron wire, and brazed or silver-soldered at the same heating; alternatively, it can be bent up each side to form a flange to go between frames, and riveted in position with $\frac{1}{16}$-in. rivets. It is quite possible that our advertisers may supply castings for



Outline and frames for Gauge "1" "Black Stanier"



Frame assembly, buffer and drag beams, and axleboxes

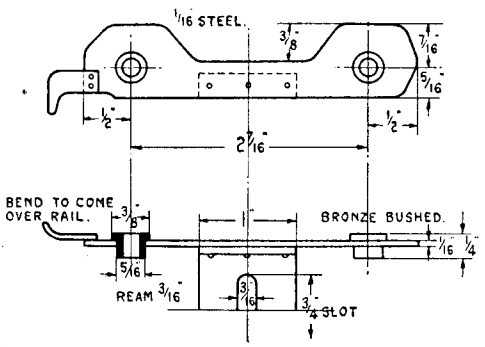
beams, complete with fixing lugs, and a bolster complete with pin. If so, I advise their use, to save time. For detailed instructions for cutting out and erecting frames, see notes about " Tich."

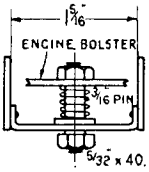
Running Gear

The axleboxes are bits of $\frac{3}{16}$-in. brass $\frac{1}{2}$ in. square, grooved both sides to slide in frame slots, and drilled $\frac{1}{4}$ in. for axles. The hornstays are 1-in. lengths of $\frac{1}{4}$-in. by $\frac{1}{16}$-in. angle brass, one of the angles being filed away at the centre, to clear the axlebox in lowest position. The spring pins are $\frac{1}{16}$-in. silver-steel, or 16-gauge spoke wire. Fit boxes first, then rivet on the hornstays, drill the spring-pin hole in middle of same, then jam each box up against the stay, and drill and tap it for the pin, through the hole in the stay. Then there is no chance of the pins binding. Springs are 22-gauge wire, held by commercial nuts and washers.

The wheels, axles, coupling-rod pins, eccentrics and stop collars, are all turned and fitted exactly as described for " Tich," but to the sizes given in the accompanying illustrations. Be careful with the quartering of the wheels, on a six-coupled engine. A couple of short lengths of $\frac{5}{16}$-in. by $\frac{1}{16}$-in. strip metal, drilled to represent coupling rods, are of great assistance in getting the pins exactly right, and the wheels to turn freely without binding. Note that the driving and trailing crankpins are not reduced where they enter the wheel bosses ; leaving them parallel, saves time and trouble. Put a brass nut over the thread to protect it whilst pressing in. Leave $\frac{5}{16}$ in. of the driving pin projecting from the wheel boss, and 9/64 in. of the trailing pin. With the axleboxes blocked up to running position—that is, with the axle centres $\frac{3}{8}$ in. from bottom of frames—the wheels should turn freely without binding, or being unduly slack anywhere, when the dummy coupling-rods are on the pins. However, don't press the second driving wheel right home on the axle until the eccentric sheaves and stop collars are fitted ; drawings of these will be given next week, all being well, along with other details. I don't reckon anybody will get as far as the wheel job in one week !

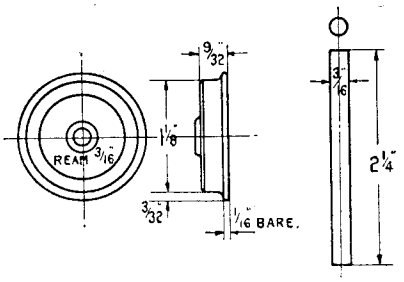
To save time, I might as well deal with the proper coupling-rods right away. They are cut from $\frac{1}{8}$-in. by $\frac{3}{8}$-in flat mild steel, either by milling or sawing and filing, as described for the bigger engine. Instead of a fork-and-tongue knuckle joint, an interlocked pin-drilled joint will do well in this small size ; but the pin must be screwed into one half of the rod. Simply pin-drill half of the thickness of each boss, and file off any bits of metal which project beyond the recess, so that the two halves interlock, as shown in the section. Tap the hole in one half 3/32 in. or 7 B.A., and screw in a bit of 3/32-in. silver-steel. Drill the other half No. 41 and countersink it. Snip off the pin to length, and rivet over both sides, leaving the knuckle just free enough to move when the engine runs over a rough bit of road, or through switch points and crossing frogs. There is no need to bush the coupling-rod bosses. If they wear much, which they shouldn't do, even after considerable service, they can be opened out and bushed when they become slack





Left—Bogie details

Below—Bogie wheels and axles

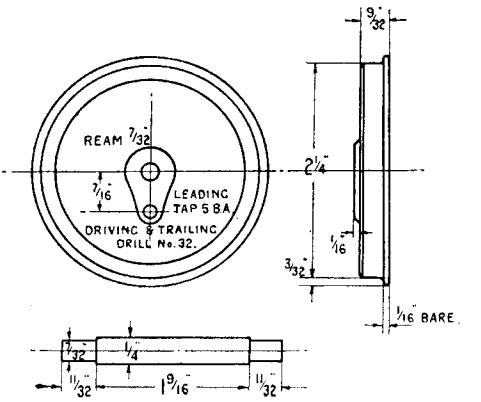


enough to warrant it. The leading boss on each side is pin-drilled 7/32 in. for half its thickness—see section—and the crankpin has a flat head to fit the recess. This pin is screwed into the wheel boss, instead of being pressed in.

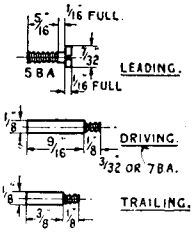
Leading Bogie

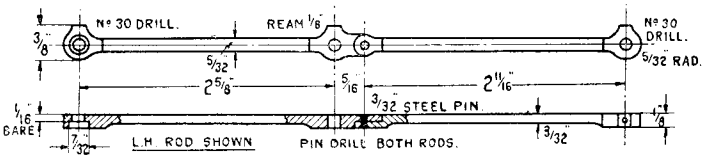
The bogie is another kiddy's practice job. The side frames of it are cut from 16-gauge material, same as engine frames. They are connected by a 16-gauge sheet metal centre piece 1 in. wide and 1 5/16 in. long, with a 1/4-in. flange bent up each side, for riveting to the side frames. Alternatively you could, if desired, simply braze a flat plate across the bottom. Whichever plate is fitted, needs a slot 3/16 in. full wide, and 3/4 in. long, cut in it for the bogie pin. This is a piece of 3/16-in. round mild steel 1 in. long, reduced and screwed 5/32 in. by 40 for 1/4 in. length at each end. One end goes through the hole in the bolster on the engine frame; and is secured by a nut above it. When the bogie is complete, the other end goes through the slot in the centre piece, with a spring and washer between, and a nut at the bottom, as shown in the cross-section. It is also quite on the cards, that our advertisers may not only supply cast bolsters with pin complete, which only need turning and facing, but also cast centre pieces, with the slot already in, and which only need smoothing off at the sides, before screwing the frame plates to them. You might even be able to get the side frames and centre piece all cast in one (like the pony truck for the 3 1/2-in. gauge "Bantam Cock") and it would only need drilling for the axles; a real "time-saver"!

Plate frames will need little bronze bushes, turned from 3/8-in. round rod as per illustration, pressed into 5/16-in. holes in the bogie frames. These take the place of the conventional axleboxes, and are O.K. in this size of locomotive, as the central spring provides the necessary flexibility. The wheels are 1 1/8 in. diameter on tread, the other dimensions being given in the drawing. The axles need no turning whatever, being merely 2 1/4-in. lengths of 3/16-in. round mild-steel. Press one wheel on each axle, poke the axle through the bushes, and press on the other wheel, keeping



Above—Coupled wheels, axles and crankpins





Right—Coupling-rods

the flange backs 1 9/16 in. apart. The guard-irons can either be cut out separately and riveted on, or cut in one piece with the bogie frames. Bend them outwards, to come over the railheads. Next items, cylinders and valve gear.

Locomotive Details on Other Jobs

Scarcely a week passes without a query coming to hand, asking if such-and-such a component, or detail, or method of construction which I have described in these notes, can be adapted to some other use. Most of them are quite O.K. and straightforward, and easily dealt with; but now and then I get either a real teaser, or one which goes from the sublime to the ridiculous. For example, somebody wanted to know what modifications, if any, he would have to make to one of my injectors, to make it operate *under water*, like a "drowned" hand-pump in a tender tank! Maybe a few words on the subject, may save time for both prospective inquirers and myself.

The locomotive boilers I have described, will do for anything needing a good supply of dry steam, provided that the boiler can be accommodated in the space available. My firebox and tube arrangements will do for any traction engine, portable, semi-portable, undertype, or stationary boiler; and in most cases the full superheating arrangements can be used as well. Several of my wide firebox locomotive-type boilers have been used for wide-beam steamers, such as small steam tugs, launches, and similar craft. We don't often hear of coal-fired boilers being adopted for miniature marine use, yet I don't know why it should be so, and have often wondered why our steamer friends seem to fight shy of coal-firing. The boiler of a 2½-in. gauge "Atlantic" engine, for instance, when in good fettle, will supply enough steam to haul a load equal to about 30 coaches, for 20 minutes or so at a time, without touching the fire. I don't know of any marine-type blowlamp that will run as long as that, without attention of some sort; also I have yet to make the acquaintance of a blowlamp which will burn as quietly as a coal fire! The loco-type boiler could be fired through a chute; and with good quality coal, could run an indefinite time without trouble, noise, nor fuss.

One of the "Maid of Kent" type outside cylinders, with half the valve-gear, would be the berries for a powerful single-cylinder stationary engine; the complete "works" of an inside-cylinder job, with motion complete, mounted up on end, would make a fine twin-cylinder vertical, or even a launch or tugboat engine. As a matter of fact Mr. Stait, the father of Dick and Allan of that ilk, who run a little "O"-gauge scenic railway at South Cerney (recollect the story of "Molly" and "Toots," the "Mollyette" sisters?) built a fine marine engine using two "Mollyette" cylinders, with motion complete, side by side, arranged vertically. Among all the cylinders and valve-gear arrangements I have described, it should not be difficult to find one or another, to suit any job within reason. With my recommended valves, ports, setting, etc., there would be no question of losing efficiency.

Pumps and injectors can be selected, from those I have described, to feed any type of boiler within reason; whilst the boiler fittings used on my locomotives are equally suitable for any type of boiler—vertical, horizontal or marine. A fine present for a mechanically-minded kiddy would be a little steam wagon, with a working steering, so that it would run on the floor, around a room. A small plain spirit-fired "pot" boiler in front, the works of "Mollyette" under the footboards, driving the rear axle through three or four gears retrieved from a discarded or broken clock, a little simple "coachbuilding" to make a realistic wagon body, and the child would have something that couldn't be purchased in any toyshop for love nor money, especially as things are now!

An Electric Clock with a Semi-free Balance

(*Continued from page* 600)

"housing," clamping the two items together to form a template. Remove job from lathe and clear all burrs, etc. Insert three short 12-B.A. screws and again clamp the two items (cover and housing) together. Rechuck in lathe and polish edges of both flanges as one.

Procure a piece of 5/64-in. glass and roughly reduce to a working diameter by "nibbling" and grinding, then proceed as follows:—

(*a*) Mount a short length of hardwood in the lathe chuck; face off and turn a recess sufficiently large to accommodate the rough disc.

(*b*) With a stick of adhesive (shellac or similar) smear all surfaces of the recess, after warming the job with a spirit lamp; also slightly heat the glass disc.

(*c*) Press the disc "hard in," applying a gentle heat in the meantime. When cool, turn the wood away sufficiently to expose the edge.

(*d*) Turn outside diameter to size, using a coarse grade carborundum slip (or diamond tool, if available) held in slide rest; do not make it fit too tightly into its spigot.

(*e*) Remove from lathe by gently heating and clean in methylated spirit or other solvent.

(*To be continued*)

Budding Shipmodellers

by Allen Walker

An anxious moment as Raymond Waller, one of the two model making apprentices, launches the S.S. "Enterprise" watched by a critical and admiring audience of fellow apprentices

TWO engineering apprentices, Raymond Waller and Albert Wragg, both aged 17, of Chapeltown, near Sheffield, recently completed their own version of the steamship model, the *Brittany*, details of which were published in recent numbers of THE MODEL ENGINEER.

The two boys are employed in the constructional department of the large Sheffield organisation of Newton Chambers & Co. Ltd. This firm has a comprehensive scheme for training apprentices, who spend one month in every six in the training centre, which is equipped with machine tools of the very latest type and is supervised by a full-time instructor, who is also one of the company's finest craftsmen. Modelmaking is extensively used during these training periods as a means of capturing the interest of the boys, and at the same time giving them valuable engineering practice.

It was with this in mind that the instructor, noting the *Brittany* model in these pages, set the two boys the problem of making the model themselves as part of their training. He was particularly influenced in this decision by the fact that the boys had already made a power unit, which although of different design from the unit recommended for the model, would, he thought, be suitable for installation, with a few adjustments. This power unit, a standard type developed by the instructor, is one which all the Newton Chambers apprentices make during their training. It is a $\frac{3}{4}$-in. stroke, $\frac{3}{8}$-in. bore, double-acting oscillating steam engine with a 6 in. × 2 in. boiler.

There were other variations, too, from the original model. In the first place, a much heavier tin plate (of 24-gauge) was used. As a result, the whole ship was considerably heavier (the total finished weight was 12½ lb.) and this meant experimenting with a heavier keel to maintain stability and balance. First efforts were unsuccessful and at the first trial the *Enterprise* (as she was named) rolled over and capsized. However, success was finally achieved with a ¼-in. × ½-in. keel which was used in place of the ½-in. × ½-in. one stipulated in the directions.

Most of the excess engine weight was due to the fact that it was built up from castings, in contrast to the original, which was largely made up from tin plate and tubing. A miniature bilge-

(*Continued on page* 611)

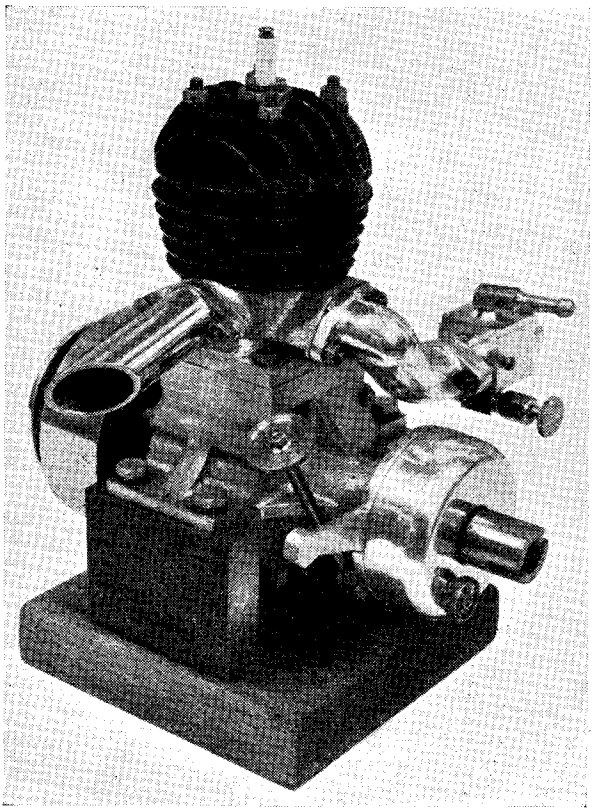
PETROL ENGINE TOPICS

A General-Purpose 15-c.c. Two-Stroke

An Elementary Exercise in Model Petrol Engine Construction

by Edgar T. Westbury

THE beginner who essays the task of constructing a model petrol engine for the first time sometimes finds his greatest problem is how to steer a middle course between the extremes of trepidation and cocksureness. On the one hand, lack of experience, or of confidence in his own ability, may cause him to make mistakes through sheer nervousness, or to seek to evade what appear to be formidable difficulties, though actually essential to successful construction. On the other hand, overconfidence may induce a lack of caution in the approach to problems, so that he falls headlong into the first pitfall; and of the two evils, I think this is the worst.



The "Phoenix" general-purpose 15-c.c. engine

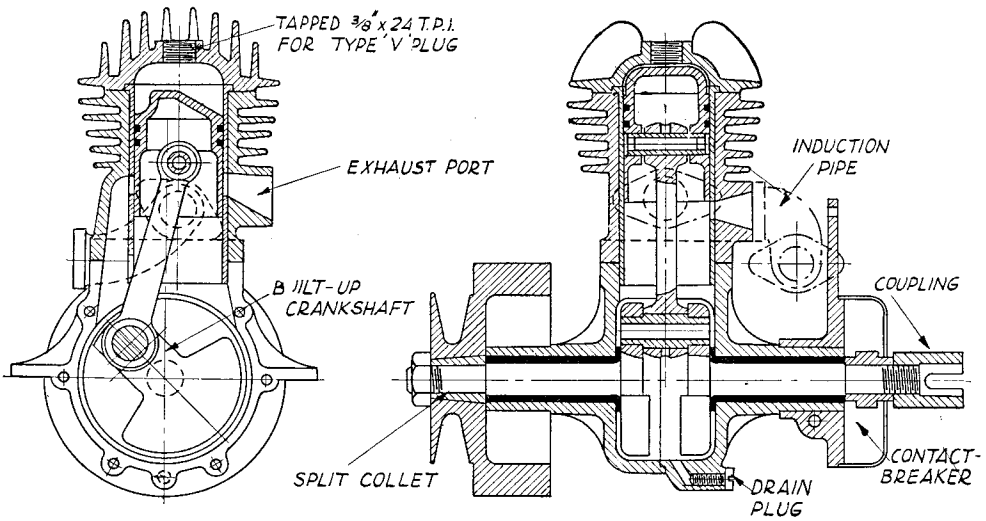
On the innumerable occasions when my advice has been sought by prospective model engineers, I have never tried to sell them the line that constructing any type of model, and a petrol engine in particular, is mere child's play; even the simplest engine one can think of demands in its construction the exercise of manual skill, general intelligence, and (that most uncommon virtue in this frantic get-results-quick age) patience. But if one accepts this as a basic and essential requirement, the average reader can be fairly confident of his ability to carry out the work successfully. It is fairly clear that he must be intelligent and mechanically-minded, otherwise he would not be reading this journal; and though he may be untrained in mechanical manipulation, practice, aided by the patience which he alone can supply, will in nine cases out of ten produce the required skill. There is overwhelming evidence available that by following the instructions of the many practical contributors in THE MODEL ENGINEER, the untrained novice can produce really sound work, and indeed many of the "beginner's efforts' which are encountered are a never-ending source of wonder to trained and experienced engineers.

It is, however, important that the beginner should undertake as his first task something that is well within his powers and facilities. This implies that the more ambitious forms of design should be avoided; but it should also be noted that many designs which *look* simple on paper, and are claimed to be specially prepared for the beginner, are not at all easy to construct in practice. Crudity is often mistaken for simplicity, and designers of alleged "simple" engines often fail to appreciate the mental and physical equipment of the beginner, who is neither a child nor an imbecile, but a human being of certainly not less than average intelligence, who is seeking a plain guide to a region which is as yet unfamiliar to him. I once heard a technical writer complain that he found it difficult to "lower" himself sufficiently to reach the level of intelligence of his readers—a fundamentally wrong idea, which may possibly account for his lack of success in

instructing them to do the right thing.

Many beginners have been completely successful in building engines to my design, though I have never considered it necessary to give these engines the studied shapelessness of a modernist sculpture, or to describe them entirely in words of one syllable. I am both presumptuous and optimistic enough to believe that my readers and I are all clever fellows together, and if some of us have more skill and experience than others, the best thing to do is to get together and share it out.

the subject of this series of articles, however, I am attempting to approach still nearer to the point of view of the beginner, by making it an actual, as distinct from a potential, beginner's effort. Usually I prefer to construct all my own engines, though the large amount of work which I have to deal with in very limited spare time, sometimes makes it absolutely necessary to delegate certain operations or complete components to trusted friends. But on this occasion, I have adopted the deliberate policy of getting the entire engine constructed by a beginner



General arrangement of the "Phoenix" engine

There is, however, always a possibility that experience may lead one to be a little intolerant of the beginner's difficulties, or fail to furnish just the kind of information he requires. I am sometimes told "It is all very well for you to tell the tale so smoothly and convincingly—you have built so many engines that it all comes naturally, but you don't realise that operations which seem quite straightforward to you are by no means as easy to us novices." Although I do not concede this as absolutely correct, it is a criticism which demands consideration, and I propose to take it into account in the description of the engine now under survey. Another point to be dealt with is that many readers believe that I have facilities for construction, in the way of elaborate workshop equipment, which are not available to the average reader. I hasten to assure them, however, that I always take the greatest care to employ and describe methods which are applicable to the simplest possible equipment. My workshop facilities are by no means elaborate—this is not entirely a matter of policy, but largely dictated by necessity—and most of the additional or special items of equipment used in petrol engine construction have been home-made.

In dealing with the 15-c.c. engine which forms

who has never built a model petrol engine before. All the machining work has been carried out on a Myford M.L.4 3½-in. lathe, except for drilling, which was done on a small (and incredibly ancient, but serviceable) Eta sensitive drill. The constructor was Mr. J. Message, who has worked under my supervision and has, I believe, experienced the same snags and difficulties as any other beginner. While he has had the advantage of being able to consult me on any of these problems, I would like to assure readers that I have not been in continuous and constant attendance; it could not be said that I have either "held his hand" or "stood over him." It may be considered, therefore, that the conditions of working have been typical of those of the average beginner, because advice on any detail of construction is available to all readers who ask for it.

Specification of 15-c.c. Engine

This engine is described as suitable for general purposes, being intended for working at moderate speed and power output, but having a much wider range of control and better flexibility than the average small two-stroke as produced either commercially or by the amateur at the present day. In the continual quest for high performance, there has been a tendency to subjugate all other

qualities to this requirement, and the result has been not only a monotony of design, but also a lack of control and adaptability which is a great disadvantage if, as often happens, a simple engine is required for purposes other than racing.

In the matter of appearance and performance, the engine is a much closer approach to the orthodox motor cycle two-stroke than most modern small engines, and may perhaps be more entitled to qualify as a "true model" in the estimation of those who have rather meticulous views on this matter. A great deal of attention has been paid to the requirements of continuous running under heavy load, or in common language, "slogging." With this end in view, the working parts are made sturdy, and bearing surfaces large in area.

A carburettor capable of single-lever throttle control has been fitted, in order to facilitate speed adjustment without "knob-twiddling," and though this is of more elaborate design than the plain suction tube type that appears to be the orthodox wear for all small two-strokes nowadays, it is sufficiently simple to avoid being a stumbling-block to the novice. It may be observed, however, that one has the option of reverting to the cruder type, if control is not considered important; personally, I consider it one of the worst-neglected features in modern small engine design. With the object of further promoting flexibility, and good load handling at lower speed ranges, the compression ratio has been kept low, which incidentally also helps to mitigate exhaust noise to some extent. The efficiency chaser may prefer to raise the compression—on his own head be it!—and it is possible to tune up the engine to produce considerably more than its standard performance if desired. Though emphatically not designed for racing, it could be developed to produce just as much power as some engines which are! The object of the design, however, is not to produce the speed and high spirit of the racing thoroughbred, but the stamina and tractability of the cob, features equally valuable in their own sphere, though often cried down by the loud and soulless devotees of speed.

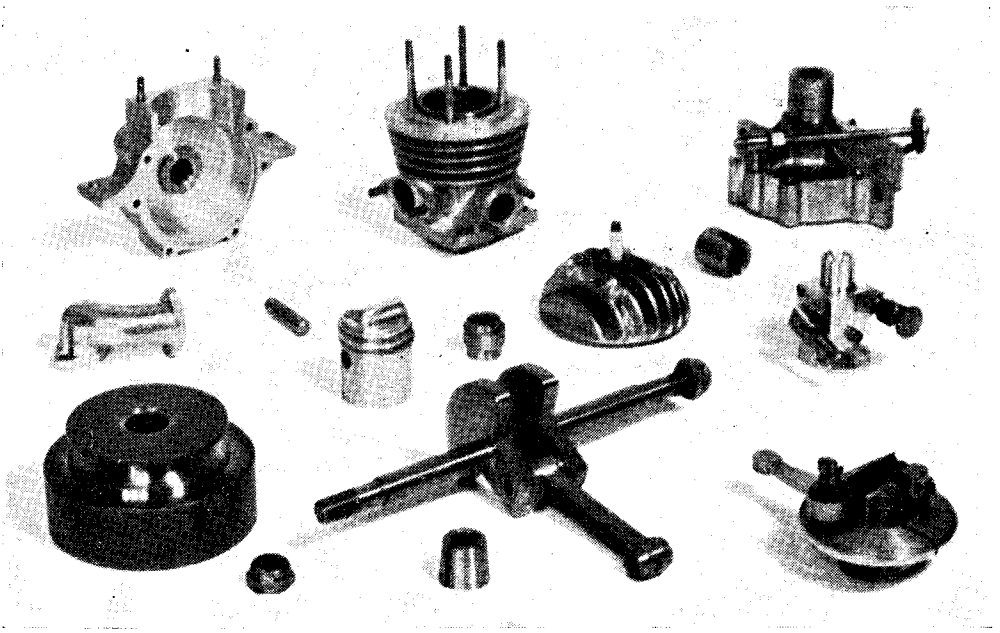
Those who have studied the application of small engines to other purposes than racing models will agree with me that it is often a great advantage to have an engine which is not continually on tip-toes and straining its heart out to keep up the required performance. In marine work, driving model launches or cruisers, the "woolly" engine of adequate size gives the most satisfactory all-round results, and though one may admire and marvel at the prodigious labours of tiny, high-screaming i.c. engines in driving boats out of all proportion to their size, one can hardly help wondering if they are really *happy* at their work! This is not an argument in favour of the "rule of the big stick"—none can be more antagonistic than myself to the very prevalent policy of using a steam hammer to crack a peanut — but that blessed term "margin of power" has a significance which most practical engineers will fully appreciate.

This engine has a bore of 1 in. and a stroke of 1⅛ in., being thus similar in dimensions to several other engines in the 15 c.c. class, both two-stroke and four-stroke which I have designed in the past. The stroke-bore ratio is greater than that which is fashionable in small engines nowadays, when all the emphasis is on high r.p.m., but there is much to be said in favour of a long-stroke engine, where flexibility, and the ability to handle a heavy load at moderate speed, are desirable features. For once in a while, I am using the normal "three-port" principle instead of providing a rotary admission valve, though this has been a salient feature of most of my two-stroke engines for well over 20 years, and has now been adopted, in one form or other, in practically all small racing two-strokes. This reversion to type has been decided upon, not only to simplify construction, but also to improve the adaptability of the design, by providing a full drive shaft at both ends of the engine, and enabling the flywheel to be fitted at either end, without complicating the fitting of the carburettor or ignition equipment. While the rotary admission valve is equally suitable for either racing or general-purpose engines, its benefits are much less pronounced in the latter case, and port admission is highly satisfactory at moderate speeds, if well designed.

The crankshaft is of the built-up type, and follows principles of construction which have been fully proved in earlier engines of my design, some of them much larger than this, and built for heavy everyday duty. I have found it advisable to permanently fix one end of the crankpin to the crank web, in this case by brazing, the other end being capable of withdrawal from its web; but it is practicable to make both ends a press fit, if accuracy and finish of the parts can be guaranteed above suspicion. The common trouble with press fits in amateur-constructed engines is that both the tolerances and finish are open to individual interpretation, and difficult to verify absolutely. (A constructor recently complained that the allowance of 0.001 in. for an interference fit on a ⅜ in. diameter bush, which I specified in a recent article, was inadequate, though I feel sure that many readers experienced in precision fitting will agree that anything much greater than this would tend to defeat its own object, by stressing the metal beyond its elastic limit.)

It is, however, possible to use a solid crankshaft in this engine if preferred, by adopting a strap-type big-end bearing as in the "Ladybird" engine. Turning a crankshaft of this size from the solid is quite a big job for a small lathe, however, and such a shaft is by no means so immune from the risk of distortion as some readers seem to think; the main difference is that a built-up shaft which gets wrenched out of alignment can be set straight again, but a solid or permanently brazed-up shaft—well, try it and see! The main crankshaft bearings are of unusual length for a two-bearing shaft, each of them being quite as long as the single bearing of many overhung-crank engines, in proportion to other engine dimensions; this feature not only gives long bearing life, but also extremely smooth and steady running.

The cylinder is of the inserted liner type, as in spite of certain obvious disadvantages in



The engine components dismantled

respect of heat conductivity and differential expansion, this type has been found very satisfactory in practice, and is much simpler for the average amateur constructor than one made from an iron casting. This applies particularly to the cutting of the ports, which in full-size practice are nearly always cast in, and left without any machining, but would be very difficult to locate accurately in a small engine. In this case, cored holes are provided in approximately correct positions in the light alloy shell, but the ports in the liner enable small errors to be corrected, and being in the form of round holes in all cases, are readily located within fine limits.

A good depth of finning is provided on both the cylinder barrel and the head, the latter in particular, but close spacing of fins is not desirable, as the engine may have to work without the benefit of " forced " draught, such as produced by an airscrew, or the rapid motion of a racing model.

(*To be continued*)

Budding Shipmodellers

Continued from page 607)

pump was incorporated, whereby the surplus steam was passed out through a specially-constructed outlet just above the waterline amidships, giving a most realistic effect as the completed vessel moved through the water.

Another variation was introduced in fabricating the stern plate, which it was found more practical, because of the heavier gauge plate, to make in two pieces, which meant that the entire hull was composed of four pieces instead of three.

The model, which is 32 in. long, 5 in. deep, and 4½ in. wide, took three weeks to build and, according to the young craftsmen and their supervisor, the drawings and directions made it a fairly straightforward job, despite the variations introduced.

Painted in brilliant red, white and black, she made a magnificent picture as she steamed across the dam where the first full-scale test was held. With the throttle full open she developed a speed of 6 m.p.h. (or rather, knots), and made a 20-minute run at various speeds without refuelling. The model has attracted a good deal of attention and admiration, and was the subject of a feature article in the company's works newspaper. We understand that several similar models are at present under construction by other model-making enthusiasts of various ages.

The Foster Showman's Road Locomotive

Another Addition to the "M.E." Blueprint Service

by W. J. Hughes

THE latest addition to the "M.E." series of traction engine drawings is the first example of a showman's engine proper, although, as mentioned before, the print of the Fowler "Big Lion" Road Loco (No. T.E. 5) may be taken as the basis of a showman's loco, with the appropriate fittings.

Conversely, of course, if anyone wants to build a Foster road loco without showman's fittings, the present drawing may be used. It is of the 7 n.h.p. type, and is drawn to 1½ in. scale. The engine is a compound, with cylinders of 6 in. and 9½-in. bore by 12 in. stroke. The slide-type valves are over the cylinders, and inclined so that the valve-rods line up with the crankshaft. This has 90 deg. cranks, with balance-weights bolted on; the valve eccentrics are between cranks.

There are three speeds, of nominally 2, 4 and 6 m.p.h., at 250 r.p.m., and these are so arranged that only one lever is used to change speeds, and only one motion can be in gear at one time—the usual and natural precaution.

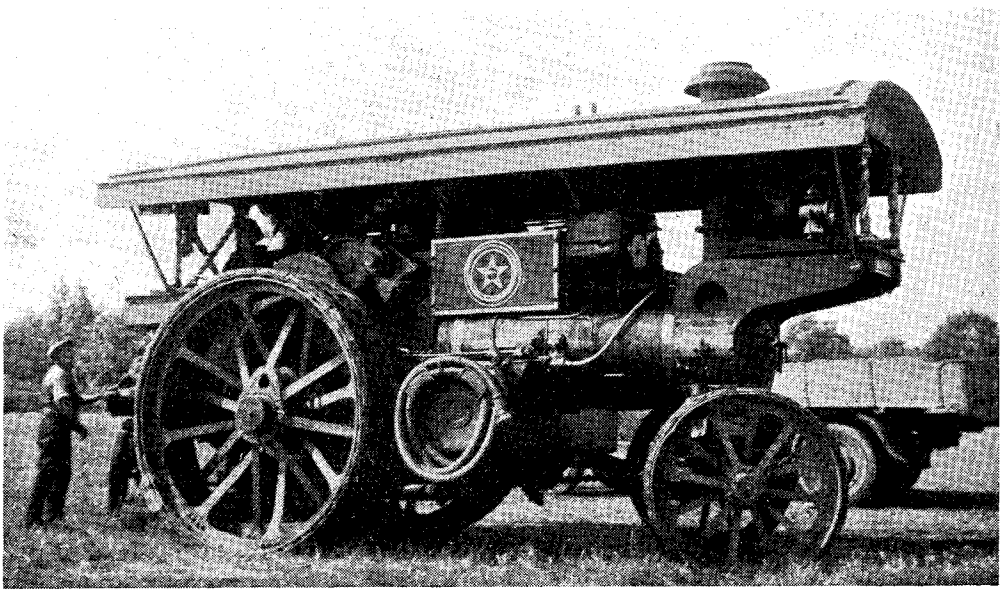
The disc pattern flywheel is turned all over, and dished to allow room for the fast speed spur-pinion to be mounted between it and the left-hand crankshaft bearing, the wheels sliding on splines machined from the solid.

The intermediate-speed spur-pinion is keyed to the shaft inside this bearing, and the slow-speed spur-pinion slides on splines outside the right-hand bearing, and also outside the pinion which drives a wheel on a short shaft mounted below it. This shaft revolves at a reduced speed in a bearing fixed to the right-hand hornplate, and inside the hornplate it carries an eccentric driving the plunger of the pump. As a duplicate feed, an injector is fitted to the main tank just behind the right-hand hind wheel.

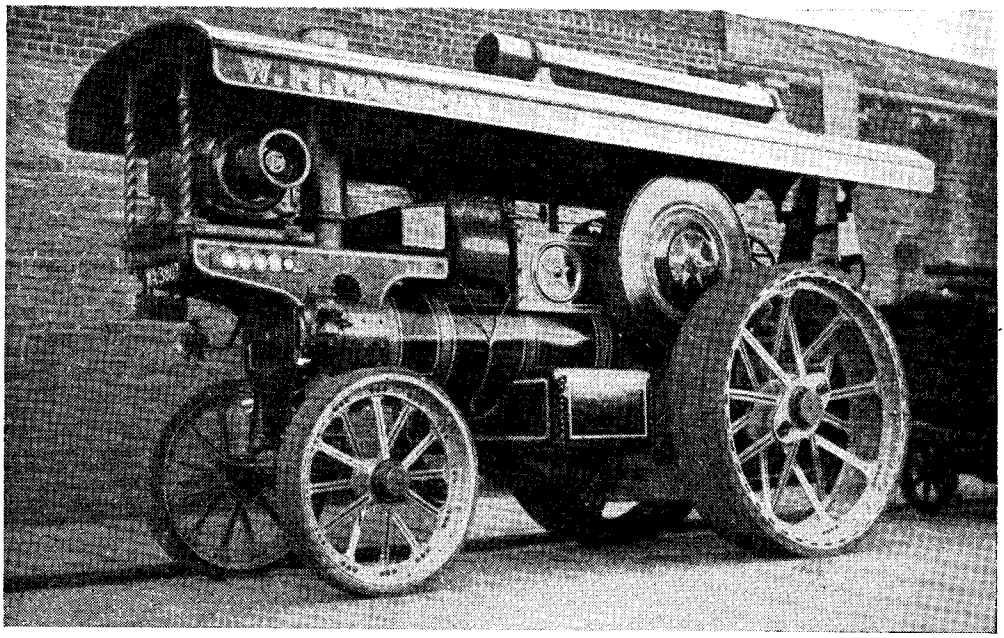
A fore-tank is fitted, of course, and connected to the main by means of an equalising pipe. The steering-gear is carried in brackets under the fore-tank, and the steering wheel is at the left-hand side. A water-lifter is fitted on top of the fore-tank at the right-hand side.

A Firm Favourite

The Foster was a make well-favoured by showmen, not only in this class, but also in the light tractor and the ultra-powerful "scenic" classes—the latter capable of some 65 b.h.p., by the way. Users have included such famous names as Patrick Collins, William Cadona, Holland Bros., Enoch Farrar, William Irvin,



A photograph by P. W. Bradley of Foster No. 12499, "Marvel"



Foster No. 14403, "James Walker," photographed by J. Wilkinson. This is one of the 65 b.h.p. class—the "scenic" type—with platform for separate exciter behind chimney, though the exciter is not fitted in this picture

H. Thurston and Sons, and many others too numerous to mention. Doubtless many of my readers will have admired these sturdy locos with their gleaming coats and highly polished brasses, as they have worked at their appointed task. [Incidentally, I hear that owing to present currency trends, many showmen are postponing the scrapping of steam road locos, and I sincerely hope this means that more of our old favourites will be seen on the roads again before so very long.]

So what about it? Wouldn't a 1½ in. scale model of one of these fine locos look grand in your hall or in the living-room? Glossy crimson lake and primrose; white, gold and red lining; glistening brass stars and twisted columns; a joy to the eye and a delight to the ear! What more could a model engineer want? And nothing too big for your 3½-in. lathe!

I am very much indebted to Messrs. William Foster & Co. Ltd., of Lincoln, for the supply of official drawings to various scales, on which my own are based, and for kind permission to reproduce.

The number of the above blueprint is T.E. 9; price 5s. 6d., obtainable from Percival Marshall & Co., 23 Gt. Queen Street, W.C.2.

Principal Dimensions

Length overall (without showman's fittings)	18 ft. 0 in.
Length overall, with showman's fittings	20 ft. 1 in.
Width overall	8 ft. 2 in.
Height to top of chimney ..	11 ft. 3½ in.
Hind wheels	6 ft. 6 in. × 18 in. or 21½ in.
Front wheels	3 ft. 11 in. × 9 in.
Flywheel	4 ft. 6 in. × 7 in.

Ladies in Engineering

The apparent apathy of the fair sex to engineering and technical matters is a by-word among model engineers, who generally consider themselves fairly lucky if their wives and sweethearts tolerate their hobby; but it is interesting to note that in recent years, an increasing number of ladies are taking an interest in engineering matters. We have recently received from the Women's Engineering Society, a copy of their fixture list for the 1949-50 season, which includes several visits to factories and other industrial centres, and a number of lectures delivered both by men and women, on a wide range of technical subjects, including "The Development of Railway Signalling," "Electric Insulating Materials" and "Soap Manufacture." There is very little doubt that ladies have the necessary natural skill and adaptability for playing an important part in every branch of engineering, and up to the present it is only the interest that has been lacking. Should further information regarding this society be required, the secretary is Miss G. Lawson, 29, Tarporley Avenue, Manchester, 14.

Angle Turning on an M.L.7

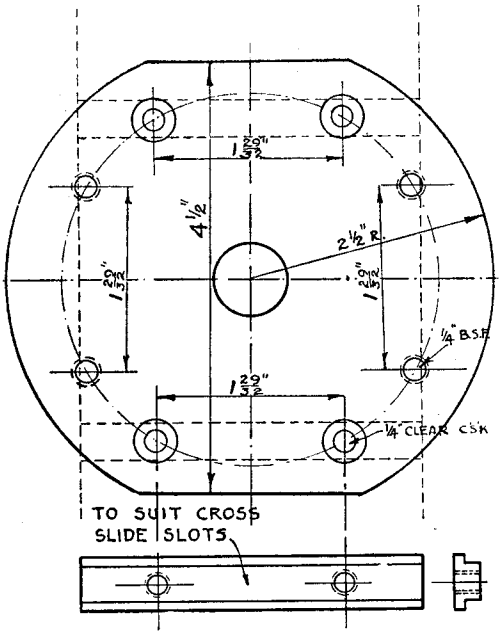
by A. R. Turpin

ALTHOUGH it is possible to carry out taper or angle turning on an M.L.7, this is restricted to include angles of less than 90 deg., and therefore it is not possible to feed in the tool at the thread angle when screw cutting, a procedure that greatly helps in the production of clean and smooth threads.

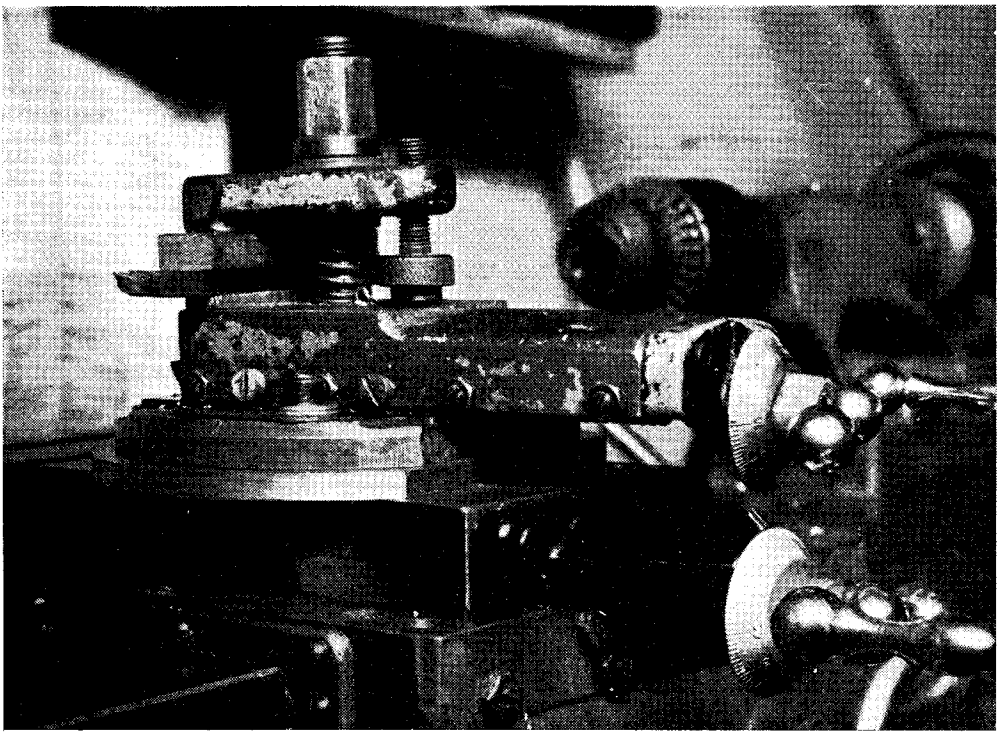
The writer, therefore, carried out a simple modification suggested by Messrs. Myfords, enabling turning to be carried out up to an included angle of 180 deg.

This consists of cutting out a piece of $\frac{1}{4}$ in. mild-steel plate to the shape and dimensions shown in the drawing, and then drilling, tapping and boring the holes as shown. Two "T" bars are next milled from $\frac{3}{8}$ in. B.M.S. so that they are a nice fit in the slots of the cross-slide, and these are then drilled and tapped $\frac{1}{4}$ in. B.S.F. to suit the countersunk holes in the plate. These hold the plate securely to the cross-slide using

(*Continued on page* 618)



The angle-turning plate and "T" slot bar

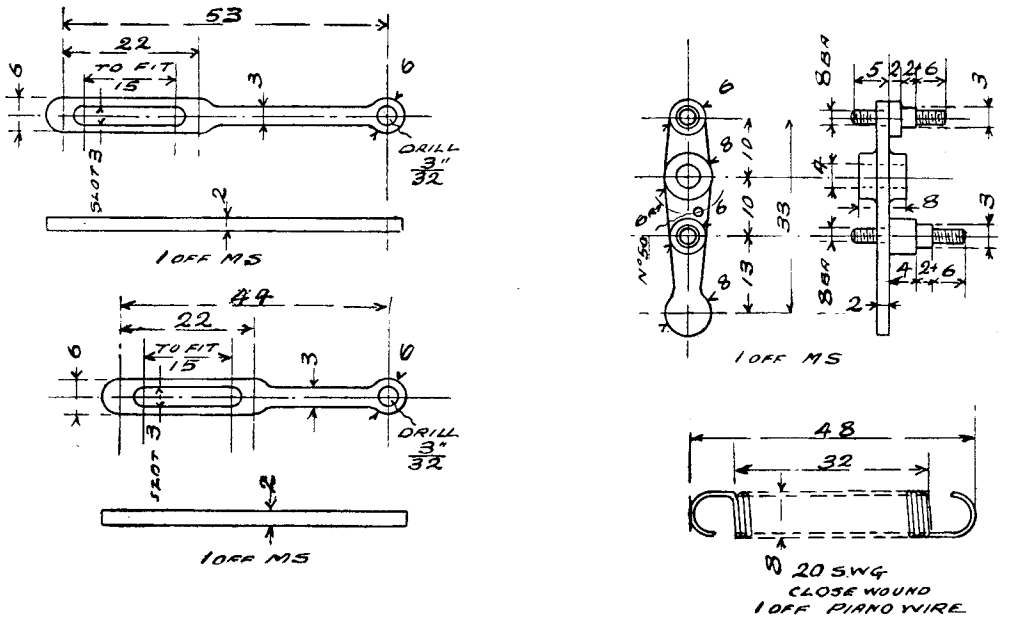


The top slide set to turn an included angle of 160 deg.

*Automatic Expansion Control for Locomotives

by G. Rhodes

IT is hoped that the drawings of the centralised linkage will explain its action. It must be emphasised that the dimensions will only be correct if the lay out as shown in the general arrangement can be adhered to. Any variation will call for some alteration to be made somewhere. If, however, the idea is grasped it should not be difficult to set out on paper. If inside cylinders



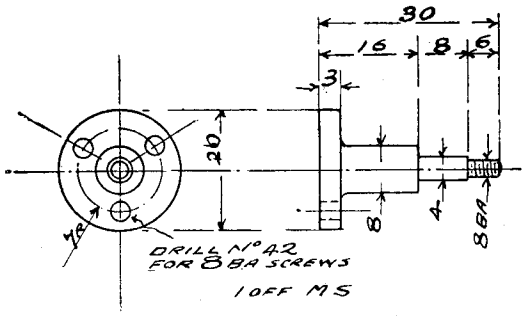
Centralising linkage details. Dimensions in 32nds of an inch, except where stated

are fitted, then a rearrangement will be required. It is possible that the whole mechanism could be turned round to come behind the weigh-shaft without even altering the dimensions of the components ; but I am afraid that there would have to be some finessing to install the pumps. The slots in the links may require final fitting in position, and metal has been allowed for this in the detail. It should be noted that the slots must permit full and free movement of the weigh-shaft in either direction when the control is out of action, that is when the ram is in the " in " position. Also, when the ram is fully extended the slots in the links should be adjusted to bring the weigh-shaft into exact mid-gear or neutral. I should advise that the slots in the links should not be cut at all until the lever on the weigh-shaft has been pinned, and then measuremenst between the pins on the weigh-shaft lever and actuating lever can be taken in three positions : free, forward and reverse and mid.

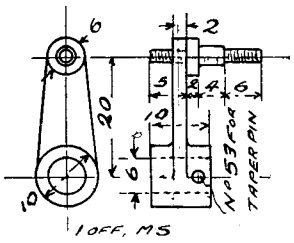
Force Pump

As stated in the first article, this is one of a three-throw unit. It is hardly to be expected that anyone would wish to modify the whole of the boiler feed to embody such a design, so I have not given any detail drawings. I would suggest that a similar design of pump already fitted to the model be made to work alongside, but to have a displacement of 1/100 cubic in. per stroke. In the pump fitted the plunger is $\frac{3}{16}$ in. diameter by $\frac{3}{8}$ in. stroke. But unless a crosshead-guide is fitted, I should suggest a $\frac{1}{4}$ in. diameter plunger by 7/32 in. stroke, or same diameter plunger as fitted to the existing boiler feed pump, modifying the stroke to give the required displacement. It may occur to the reader to wonder whether the intermittent flow from the pump is likely to make the control jerky in action ; but as the hydraulic cylinder is so large compared with the pump, it is not noticeable.

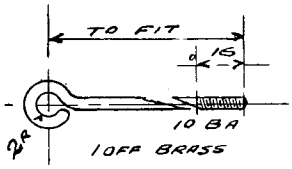
*Continued from page 545, " M.E.," October 27, 1949.

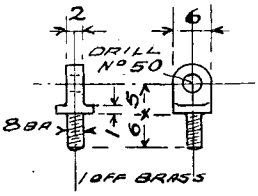


SREWS, NUTS
ATTACHMENT SCREWS, 8BA C'SUNK TO SUIT NUTS, 8BA. 10 OFF
WASHERS, 8BA 5 OFF

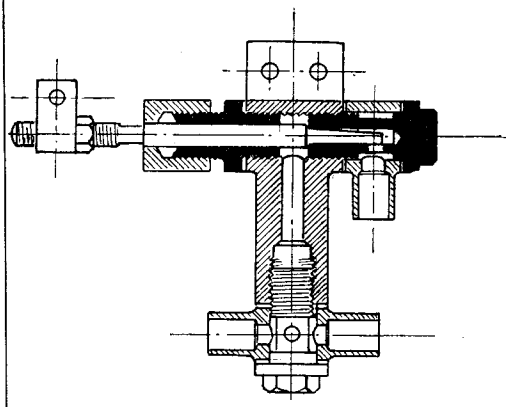


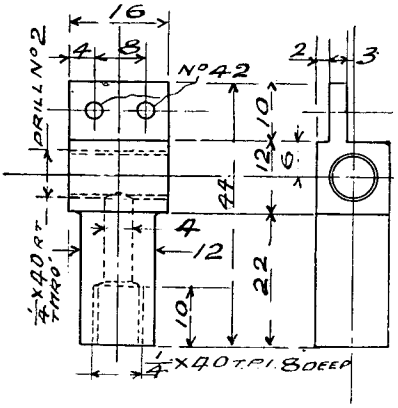
1 OFF, MS





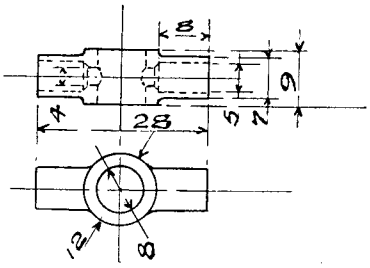
Centralising linkage details



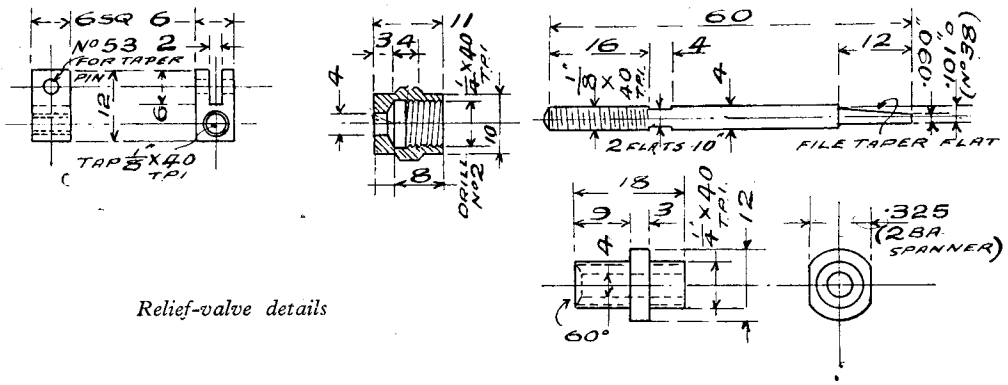


STANDARD PARTS AND PARTS ALREADY DETAILED

BANJO, SINGLE, 1 OFF
NIPPLE, 2 OFF
FIBRE WASHER 5 OFF
NUT. ⅛"X40 1 OFF
TAPER PIN ⅛" 1 OFF
ATTACHMENT BOLTS 8BA. 2 OFF



Relief-valve details. Material—brass 1 off each. Dimensions in 32nds of an inch., except where stated



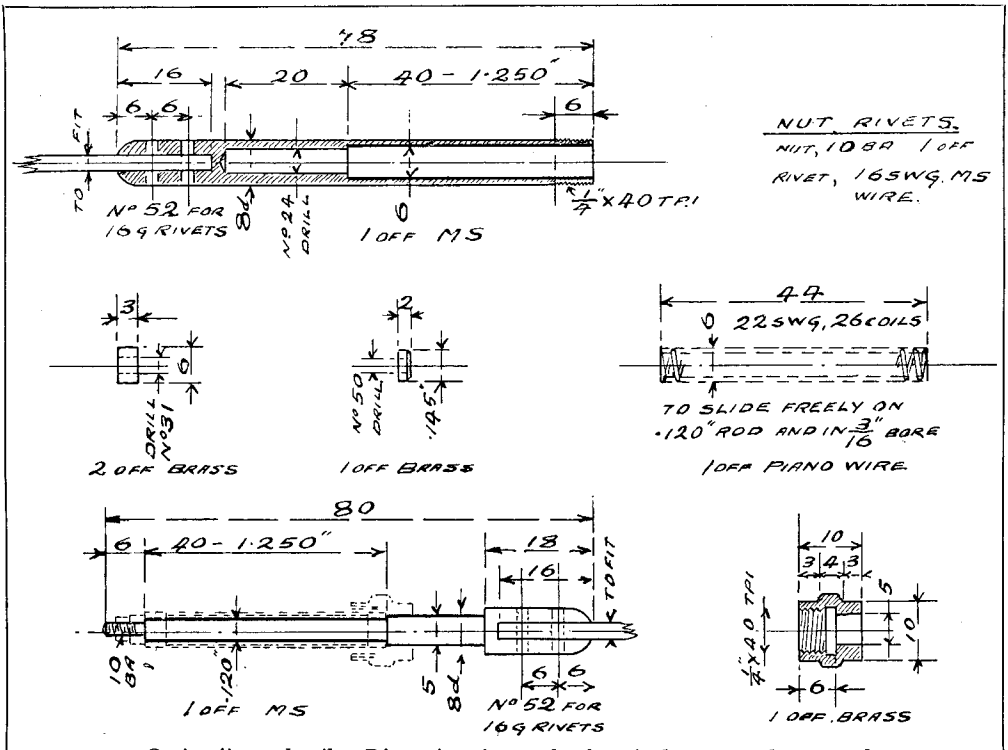
Relief-valve details

Relief-Valve

Assembly and details are shown, and I hope will be self-explanatory. It will be noticed that the needle is parallel, the adjustment of the aperture being obtained by a tapering flat. This is easier to make than a cone, as the aperture needed is extremely small, and the flat, if not too large initially, can be increased easily if found necessary. The full travel of the needle is $\frac{5}{16}$ in., and the movement of the control should not allow more than this. In the general assembly the valve and control are shown mounted on the right-hand, or off side, which, earlier on, used to be the driver's side. The driving side is now usually the platform side, and most models conform to this. The valve can be mounted either side, as the body is symmetrical, and can be right or left by changing the assembly. It should be easier to connect up if it is on the same side as the control.

Spring Jigger

Detail drawings are shown. It consists of one spring sliding freely on the internal shaft, between two collars which are also a free fit on the shaft. The spring is pre-loaded so that the



Spring jigger details. Dimensions in 32nds of an inch, except where stated

centralising of the jigger is definite. The collars and spring must also be a sliding fit in the tube or body. The dimensions between the shoulders on the shaft and the depth of the bore in the body should be the same. The dimension on shaft and bore is given as 1.250 in. in decimals to emphasise the need for exactness, but only to the extent that they should be the same. If there is any difference, there would be some slackness in the central position, but this can be corrected by making the dimensions the same, the dimension is not important in itself to a 32nd of an inch. The jigger allows for a 9/16 in. full travel of the bridle rod; if the movement is less it does not matter, but if more, the 1.250 dimension should be increased by the difference by making the body so much longer and the shaft to correspond.

Control Connecting Relief Valve

As shown in the general assembly, a lever is mounted concentrically with the reverse lever. In the particular model this position and method of mounting is very convenient and neat. The lever type of reverse is not popular except where the reverse is controlled by telemotor; it is usually by a screw wheel, the method mostly adopted on models, so that it is extremely unlikely that the arrangement shown could be used. It may be possible to fit a lever in the cab on the lines shown, but it would seem that the exact arrangement must be left to the ingenuity of the reader, and so no details are given. One condition must be observed, and that is that the control should not restrict the movement of the relief valve needle. Should the pressure become excessive, it is intended that the needle should be able to give way so as to relieve pressure, as there is no other relief or safety valve fitted. Under normal conditions, the friction in the gland is sufficient to retain the needle in its set position.

Piping

The "plumbing," I think, will be quite clear from the assembly. If the relief is mounted on the other side, it should present no difficulty in changing the piping. The supply to the force pump is from the same pipe supplying the boiler feed, and the flow from the relief valve is fed back into the same pipe. It has been my practice to fit only one supply pipe from the tender which does duty for hand pump, mechanical pumps and return if the mechanical pumps are by-passing. This simplifies the coupling up of the tender. After having got steam, it is a nuisance to have to fiddle with everything fizzing. It also enables the valves in the mechanical pumps to be cleared by using the hand pump.

When first trying out the scheme, it was found that the engine, with more than scale load, ran too fast for the track, although the curves were not less than 25 ft. radius. The control had linked up to mid-gear, but did not give sufficient check on the speed. To overcome this, the lead of the valves was reduced. It would seem that the lead should not be more than 5 degrees. I do not see that there is any virtue in excessive lead, all that is necessary or desirable is that the cylinder should be filled by dead centre, any excess creates back-pressure and retards starting. Under regulator control, the steam is throttled; and so under running conditions extra lead would be justifiable if two wrongs can make a right.

The drawings show the control as fitted to a ½-in. scale loco, but the control to the same dimensions would be quite suitable for ¾-in. scale, adjusting the travel of the jigger to suit the travel of the bridle-rod, as explained in the paragraph dealing with this component. A stronger spring *B*, say 18 instead of 20 s.w.g., would probably be an advantage on this scale. The control would be applicable to any type of valve-gear; but some put more loading on the bridle-rod and modification might be required to suit such.

If anyone fits this control, it would no doubt be of interest to other readers of THE MODEL ENGINEER; it would be of the greatest interest to the writer. Should any snags arise, the writer will always be pleased to do his best to help in overcoming them.

Angle Turning on an M.L.7

(*Continued from page* 614)

four countersunk screws. The top slide is secured to the plate by two ¼ in. Allen screws, or ordinary bolts, if preferred. It will now be possible to turn any angle up to 180 deg. (included), but it will be found that if the included angle is greater than 175 deg., the movement of the slide is somewhat restricted owing to the micrometer dial and handle fouling the cross-slide extension. This drawback could be overcome by making a special extension handle for the top-slide.

The addition of the extra ¼ in. of height to the top-slide prevents the normal tool holder being used, but plain tools up to 7/16 in. in depth can still be used.

Having finished all work on the plate, it should finally be hand scraped, and a zero index-mark cut on the plate.

The photograph shows the plate in position, but the dimensions of this plate are slightly different from those shown in the drawing, because the writer wished to use material that was to hand.

PRACTICAL LETTERS

Licence-free Radio Control Transmission

DEAR SIR,—We understand from one of our customers that a warning was recently published in THE MODEL ENGINEER " that it is illegal to operate any form of transmitter without a licence."

May we point out that a visit to, say, Fairlop Aerodrome on any Sunday would reveal the extent to which this is untrue? In fact, for the last five years the G.P.O. has allowed licence-free radio transmission for model control under the following conditions :

(a) The bands allowed are 26.96 to 27.28 megacycles and 465 to 465.5 megacycles.
(b) There must be not more than 5 watts input to the transmitter.
(c) No attempt must be made at communication work.

We are indeed lucky in this country to have this privilege, but modellers must understand that the G.P.O. would quickly withdraw it should abuse of it become at all apparent.

Yours faithfully,
W. H. C. TAYLOR,
for the " Flight Control " division of Judge Industries.

Manor Park, E.12.

(We have discussed this matter with the organisations concerned including the Radio Controlled Models Society and we find that the information given here is correct, but it should be very carefully noted that this permission is only applicable to radio control of models, and under no circumstances must telephony or similar two-way communication be attempted, or the privilege will be withdrawn. It is advisable that the frequencies used should be very carefully checked with a wave meter, so that there can be no question of interfering with other wave bands.—ED., " M.E.")

International Racing !

DEAR SIR,—The article on the above subject by Geo. H. Stone, published in your issue of October 6th, should not be allowed to pass without comment. The title should surely have been " How I Won the Swiss International Regatta," and an acknowledgment to Dooling Bros. of California would not have been out of place, possibly in the form of the Stars and Stripes on the side of the hull. They deserve 90 per cent. of the credit. They made the engine.

I am also surprised that the 30 c.c. event was dismissed in just over two lines, giving the winners and their speeds also again in the table of results as if to increase Mr. Stone's superiority still further.

The observation that Victoria Park is only suitable for speeds below 50 m.p.h. is an admission of defeat. Because *Lady Babs* will not do this speed there (actually I think that his maximum is considerably less) does not mean that it is impossible. Speeds at Victoria Park have gradually increased until this year the 50 m.p.h. mark has been passed and there is no earthly reason why it should stay at this figure. Its the hull which keeps the boat on the water and I think Mr. Stone is responsible for the hull. His remark about drawn out straight running events is not justified. They form a useful change to the hydroplane events and most certainly interest the spectators. Their owner's subscriptions are also useful to the power boat club's finances.

The president of the average power boat club can not ask all the competitors to a party, but visitors to the Bournville and Coventry regattas will know what can be done in the way of hospitality in this country.

I should also like to thank Mr. Stone for any small share of the credit which may be due to me for running a boat and keeping the interest going.

Yours faithfully,
Runcorn. R. E. MITCHELL.

The " Eureka " Clock

DEAR SIR,—I was very interested in Mr. G. H. Thomas's letter on the " Eureka " clock and the compensation of balance wheels.

I feel sure that an article on " Balance Wheels " would be most helpful, and that many readers of your magazine would be interested.

I realise that I am running the risk of starting up an old controversy and also that your experience shows the kind of articles most people like, but may I suggest that more information be given which is generally useful to the " home mechanic " as distinct from the " modeller."

There must be quite a large percentage of your readers who do not use their time making models, but are prepared to spend many hours in their workshops making things that can be put to some practical use.

Yours faithfully,
Hessle, E. Yorks. H. J. MARCOOLYN.

Model Power Boat Articles Wanted

DEAR SIR,—I was interested to note in " Smoke Rings," in a recent issue, of the various British Model Power Boat successes.

We, in the Glasgow Society of Model Engineers, can only get particulars of these boats through THE MODEL ENGINEER, and we are keen to have descriptions and drawings of these boats which have put up such fine performances.

Descriptions of the various regattas this year have been good and well illustrated, but there is a lack of information on the boats themselves.

Yours faithfully,
Glasgow. D. C. JEFFREY.

A Centre Engine

DEAR SIR,—On reading your contributor's article on the subject of little-known traction engines, I was much intrigued by the curious example shown of a " traction centre " showman's engine, said to be made for a set of switchback gondolas.

I thought it may be of interest to let your readers know that a set of switchback gondolas was seen by the writer at Bridgwater Fair quite recently, steam-driven and with organ complete, in excellent condition and still doing good

business, owned by a showman named Cole. I was struck by the unusual position of the engine which was different from any arrangement seen before, and the position would correspond with that described in your article. The makers were Messrs. Savage, of King's Lynn.

It seems possible that this may be the same, or an identical machine, described, and if so, it is remarkable that the whole outfit has survived in such good order for so many years.

At the same fair were some steam-driven "gallopers," not quite so well preserved, and two years ago I saw a steam set of "gallopers" in absolutely mint condition in the Tamworth area. I consider all these are worth seeing in this electrically dominated age and the showmen who preserve their machines in such good order are deserving of some words of appreciation from those who are still fascinated by the motion of cranks, links and piston-rods!

Yours faithfully,

Castle Bromwich. L. H. POWELL.

CLUB ANNOUNCEMENTS

The Dursley Model Engineering Society

The above society hope to hold an exhibition of models in Dursley on December 8th, 9th and 10th next, and would like the co-operation of the surrounding clubs and societies.

This is the first time a model engineering exhibition has been attempted here, and will be, for the above society, a pioneer effort.

Any offers of help should be addressed to the Exhibition Secretary, R. MUMFORD 55, Cropen Bungalows, Dursley, Glos.

Harrow and Wembley Society of Model Engineers

The future programme is as follows :—

November 23rd. "Woodwork in Modelmaking," by P. Winton.

December 14th. "Electricity in the Home and Workshop," by M. Ashley.

All meetings at Heathfield School, 7.30 p.m.

Hon. Secretary: J. H. SUMMERS, 34, Hillside Gardens, Northwood, Middx.

Glasgow Society of Model Engineers

The Edinburgh society is to join us in a combined meeting on December 17th next, at 3 p.m., in the society's rooms at 60, Clarendon Street, Glasgow, N.W.

Visitors will be welcomed and particulars of membership can be had from the address below.

Hon. Secretary: JOHN W. SMITH, 785, Dumbarton Road, Glasgow, W.1.

Sutton Coldfield and North Birmingham Model Engineering Society

An interesting talk was given at our October 11th meeting by member H. G. Barr, a driver on the London Midland Region, entitled "A Day on the Footplate." Arrangements are almost complete for our exhibition to be held at the Church House, Erdington, on November 11th and 12th, when over 200 models will be on view, including the three ship models with which the Birmingham Ship Model Society won the Club Championship Cup at this year's "M.E." Exhibition. The exhibition is to be opened by the Mayor of Sutton Coldfield.

Programme for the rest of the year is as follows :—

Friday and Saturday, November 11th and 12th. Exhibition.

Tuesday, November 22nd. Exhibition Report.

Tuesday, December 6th. Social Night. (Ladies invited.)

Tuesday, December 20th. Open Night.

All meetings at the Yenton Hotel, Sutton Road, Erdington. Membership has now passed the 70 mark, but there is still plenty of room for new members.

Hon. Secretary: C. F. PALMER, Kingstanding, Birmingham, 23.

The City of Bradford Society of Model and Experimental Engineers

Mr. Wood, who was secretary of the above society, has found it necessary to resign owing to pressure of work.

These duties have now been taken over by E. HAMMOND, 83, Norman Avenue, Eccleshill, Bradford, Yorks.

The Junior Institution of Engineers

Friday, November 11th, at 6.30 p.m., 39, Victoria Street, Westminster, S.W.1. Chairman's address, "The Inventor and the State," by Geoffrey W. Tookey, K.C. (Member.)

Friday, November 18th, at 6.30 p.m., 39, Victoria Street, Westminster, S.W.1. Annual general meeting and annual meeting of contributors to the Benevolent Fund.

North-Western Section. Saturday, November 19th, at 2.30 p.m., Manchester Geographical Society, 16, St. Mary's Parsonage, Manchester. Ordinary meeting. Film, "The Technique in Application of Tungsten Carbide Cutting Tools."

Ickenham and District Society of Model Engineers

Our programmes are fixed until December 30th, something different every week. Two outstanding nights are worthy of note. December 9th, "Model Boat Construction," by Mr. Ablett and December 16th, "Modern Railway Developments," by Mr. K. A. C. R. Nunn, of British Railways. Mr. Ablett has already shown us some of his planked boats which are beautiful examples of this class of work.

Meetings are held every Friday at 7.30 p.m. in the Memorial Hall, High Road, Ickenham.

Visitors and prospective members are particularly welcome.

Hon. Secretary: A. R. DUNN, 27, Ivyhouse Road, Ickenham, Uxbridge, Middx.

Portsmouth Model Engineering Society

At the model engineering exhibition held at the Assembly Hall, Worthing, in September, Portsmouth modellers' magnificent show captured most of the prizes, and their stand attracted great admiration from viewers. The prizes were awarded as follows: Mr. E. Scott, for a 2½-in. gauge "Princess Royal" locomotive—a silver shield; Mr. T. A. Bedford, for a waterline setting of H.M.S. *Tuscan* and S.S. *Empire Viceroy*—silver shield; Messrs. W. and C. Chandler for an Austin type model car—the Worthing Town and Austen-Walton silver challenge cups; and for racing hydroplanes—a certificate of merit; Mr. C. Chandler, for an automatic electric timing apparatus for timing race cars—a silver shield. The Austin car, hydroplane, and the timing apparatus were entered as a team, and was runner-up for the Crusader Trophy which was won by Brighton M.E.S. who beat the Portsmouth team by only three points. Other entries were submitted by Messrs. Dreier, N. Norway, T. Bedford, Mrs. G. Butt, Capt. A. C. Hall and Cmdr. F. Allison.

During National Savings week in October the society staged a pocket exhibition in the foyer of the Regent cinema which proved an excellent advertisement for the society. It was intended to be an hors d'oeuvre of models of the full-size exhibition to be held in March next year.

Work on the model railway continues, and the "stud contact" system of electrification has been adopted with considerable success. Most of the track is now in position and construction of the various lineside features are being tackled.

Further particulars relating to the society's activities and meetings can be obtained from the Hon. Secretary, CMDR. F. J. ALLISON, 21, Carmarthen Avenue, Cosham, Portsmouth, Hants.

NOTICES

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. **All such correspondence should be addressed to the Editor (and not to individuals)** at 23, Great Queen Street, London, W.C.2. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

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